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CONGENITAL SINGLE KIDNEY, WITH THE REPORT OF A CASE; THE PRACTICAL SIGNIFICANCE OF THE CONDITION, WITH STATISTICS.*

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The subject of "single kidney" is admittedly of considerable surgical and anatomical importance, but it is also one of decided interest to the internist and pathologist. The condition was known to and imperfectly described by some of the early writers, more particularly Vesalius and Eustachius. Various classifications of "unsymmetrical kidney" have been proposed—first by Morgagni in 1769, and later by Rokitansky, Morris, and other writers. These have, as a rule, included cases in which one kidney is merely atrophied as the result of disease, or undeveloped, and also the instances due to a fusion of the two organs. I have, however, discussed here only cases in which one kidney is entirely and congenitally absent. All those instances in which any rudiments or remnants of renal structure were detectable in the situation of the kidney have been omitted from consideration.

As regards the frequency of occurrence of the condition, there is marked diversity of opinion among writers. According to MacDonald Brown,[1] cases of single kidney are exceedingly rare. For example, in nearly 12,000 autopsies made in the various London hospitals prior to 1893, only 3 cases were found. He continues:

* Read at a meeting of the College of Physicians of Philadelphia, December 1, 1909; and in a modified form at a meeting of the Luzerne County Medical Society, Wilkes-Barre, Pa., November 24, 1909.

"Indeed, only slightly over 100 cases have been recorded altogether, and even many of these were doubtfully true 'single kidney.'" Morris[2] observed but 2 cases in 8069 cadavers, Sangalli[3] 3 cases in 5348 necropsies, Menzies[4] 2 cases in 1790 sections, Petersen 1 case in 1500, Camargo[5] 2 cases in 3000, Owtschinniskow[6] 1 in 3800, White and Martin (quoting Mawkiewiez[7]) 1 in 3992, and Rootes[8] 1 instance in 600 autopsies. Ballowitz[9] prosected 617 bodies (of which 121 were females), and found 1 example of "single kidney" associated with defective development of the genitalia of the same side. He also observed 2 additional cases through the courtesy of his colleagues. Preindelsberger[10] found 2 instances of "single kidney" in 1344 sections, Reinfelder,[11] in the Munich Pathological Institute, met with 1 case in 400 autopsies, and Winter's[12] statistics show 13 cases out of 32,415 sections. Heiner[13] (through the courtesy of Dr. Sternberg) presents the figures of the Prosector at Brunn. Out of 8853 sections, from 1895 to 1905, 3 cases of asymmetrical kidney were found. Again, of 2145 sections, from 1906 to February, 1908, two subjects showed total absence of one kidney.

Among American authors, I find Weir[14] contending that single kidney occurs only once in 5000 subjects, and Guiteras[15] found, on analyzing a table of 15,904 autopsies, that in four cadavers there was absence of one kidney, that is, complete absence of one organ in about 4000 instances. Says Dennis,[16] according to available statistics, complete absence or extreme atrophy of one kidney is found once in 2650 cases. The statistics obtained from the records of routine postmortem work in certain leading hospitals of Philadelphia give somewhat similar results. For example, at the Pennsylvania Hospital 1 case was met with in 1250 postmortems; in 600 necropsies conducted at the Protestant Episcopal Hospital by Dr. William Egbert Robertson no case of the sort was encountered. Dr. C. Y. White informs me that he has not met with a single case of complete absence of one kidney in a personal experience covering 1800 autopsies. On the other hand, the records of the Philadelphia Hospital furnish 8 cases out of a total of 6240 autopsies (see table).

Moore[17] (in 1898) found, in averaging certain previous statistics that the "expectation" of "unsymmetrical kidney" was about 1 in 2400 autopsies. The aggregate of the foregoing figures, together with those accessible among the hospitals of Philadelphia, at the present writing, or a grand total of 92,690 postmortems, gives a ratio of 1 in 1817 autopsies.

The precise number of cases of congenital single kidney recorded in literature, answering to the definition given above, remains somewhat in doubt on account of the vague character of the reports of some of the earlier writers. Ballowitz,[18] in 1895, collected from the literature 210 cases, which, in addition to 3 observed by himself, gave a total of 213 cases. Moore, in 1898, published 12 additional references, and thus brought the total number up to 225

cases in that year.* The two writers last cited (like myself) aimed to exclude those instances of "unsymmetrical kidney" in which the organ was much wasted as the result of disease processes, was undeveloped, and those resulting from fusion of the kidneys. Radasch,[19] in 1908, wrote: "If we accept 240 cases up to the appearance of Ballowitz's paper, then at least 15 more must be added, making a total of at least 255."

I have endeavored to collect the cases of genuine "single kidney" to be found in the literature since the publication of Moore's article in 1898 (a considerable number having escaped the scrutiny of more recent writers), together with a few scattered earlier cases, with a view to showing the grand total of all recorded instances of the condition to date. With the kind aid of my associate, Dr. H. Leon Jameson, I have found in accessible literature and the autopsy records of certain Philadelphia hospitals no less than 61 genuine cases, making the sum total to date 286 cases. These are reasonably accurate figures, and in future the number of cases belonging to this category need not remain in doubt, since the reports will doubtless be far less ambiguous than those of the earlier writers. I consider it to be a matter of considerable importance to have secured statistics, the results of an analysis of which point to definite conclusions, both as regards the question of "expectation" and that of the pathological and practical bearings of "single kidney." A consideration of the figures given in the accompanying table, in which 61 instances of the condition are detailed, will show interesting results. Before attempting an analysis of the tabulated list of cases, however, I shall give the notes of a case personally observed, together with various conclusions to which they point:

W. B., aged sixty-four years, a varnisher, a native of England, weighing 160 pounds, and five feet eight inches in height, was admitted to the Medico-Chirurgical Hospital April 10, 1909. The family history was good, except that his father died, at sixty-four years of age, of Bright's disease, and one brother at the age of sixteen, suddenly, but of unknown cause.

The patient had had all of the commoner childhood's diseases, including scarlatina; subsequently he continued well until eight or nine years ago, when rheumatism developed; it was of a subacute type and did not confine the patient to bed; he has had several recurrences of a similar nature during the past eight years. Last July one year ago, while working at his trade, his right arm, from elbow to finger tips, particularly on the ulnar side, as well as his right leg, from the knee down to the toes, manifested a sense of numbness, which, however, passed away in the course of fifteen minutes. Last July he had a similar attack, which left his hand in a drawn or partially closed condition; it is now straightened out, except that his middle finger is still distinctly contracted.

* This writer actually published 13 references, but one was a report of a horseshoe kidney, hence omitted.

Reporter	Age and sex	Which absent	Ureter	Renal artery and vein	Corresponding suprarenal	Condition of genitalia	Condition of existing kidney as to size, shape, position, and lesions present.
Darby[20]	60 yrs.; female	Left	.....	Absent	Absent	.....	Kidney healthy; carcinoma of bladder and lungs.
Isaacs[21]	3 mos.; male	Left	Absent	....	Present	.....	About twice natural size, 2¾ x 1¾ x 1¼ in.; lobulation characteristic of infantile kidney; healthy; deceased of pneumonia.
Turner[22]	Past middle life; female	Left	.....	Absent	Present	Uterus unicornus	Not hypertrophied; no lesion.
Wier[23]	Male	Left	Absent	....	.....	.....	Enlarged, 5 oz., 2 drams; normal, healthy.
Ingals[24]	Middle aged; male	Right	Lower end dwindled for 4 in.	....	.....	.....	Normal size, roughened surface, pale and hard, cortical substance thick; contained two cysts.
Fenby and Walker[25]	...	Right	.....	....	.....	.....	Enlarged, weighing 9½ oz.
Peabody[26]	21 yrs.; female	Left	Absent	Two right arteries, none on left	Present	Uterus bicornate; right side better developed	Normal situation, double normal size.
Peabody[27]	61 yrs.; male	Right	Absent	Two renal arteries to left kidney; none on right	Present; normal	Normal	Double usual size, capsule of Bowman thick; interstitial inflammation; small hemorrhagic infarction.
Church[28]	45 yrs.; female	Left	Absent	Absent	.....	.....	Very small, not larger than a large hen's egg and shaped much like one; shows interstitial nephritis.
Church[28]	65 yrs.; male	Left	.....	....	.....	.....	Very large and healthy; deceased of gastric carcinoma.
Ebstein[29]	21 yrs.; female	Right	Absent	....	.....	Right cornu of uterus absent	Chronic pyelitis and chronic interstitial nephritis.
Smith[30]	33 yrs.; male	Left	.....	....	.....	.....	Enlarged, weighing a little more than 7⅓ os.
Hand[31]	...	Right	Absent	....	Present	.....	Compensatory hypertrophy; patient had lumbo-sacral meningocele.
Murray[32]	8 yrs.; male	Right	Absent	Two small vessels from bifurcation of aorta	.....	.....	Large kidney, dilated pelvis; impaction of ureter with calculus; situated in hollow of sacrum behind bladder, more to left than right.
Lohsse[33]	Adult; male	Left	Absent	....	.....	.....	Considerably hypertrophied, otherwise shows no pathological change.
Israel[34]	52 yrs.; male	Right	Absent	Artery absent	.....	Testicle 2 cm. long; is in pelvis	Enlarged, 12 cm. x 8 cm. x 6½ cm.; in normal position.
Bauer[35]	22 yrs.; male	Left	Absent	Present, but very small; vein absent	Present and normal	Left vas deferens and seminal vesicle absent	Slightly enlarged, weight 190 gms.; normal position and form.
Francois-Dainville[36]	...	Right	.....	....	.....	.....	Very large, weighing 430 gms.; surface lobulated, somewhat congested.
Beaufume and Carron[37]	47 yrs.; male	Right	Absent	....	Right absent; left weighed 9 gms.	Right testicle small but appears sound; left in inguinal canal and is markedly atrophied	Weighs 250 gms., structure unaltered; normal situation; associated with total inversion of the viscera.

Reporter	Age and sex	Which absent	Ureter	Renal artery and vein	Corresponding suprarenal	Condition of genitalia	Condition of existing kidney as to size, shape, position, and lesions present.
Guiteras[36] (Case I)	21 yrs.; male	Right	Absent	....	.....	.....	5 x 3 x 2½ in.; lobulated, had but one pelvis; showed evidence of tuberculosis and nephritis.
Guiteras[36] (Case II)	30 yrs.; male	Right	Absent	....	.....	.....	7½ x 4 x 2½ in.; not distinctly lobulated, but somewhat irregular on surface; normal position; acute parenchymatous nephritis.
Guiteras[36] (Case III)	25 yrs.; male	Left	Absent	....	Absent	.....	4 x 2½ x 2 in.; five or 6 irregular elevations on its surface; somewhat lobulated; single pelvis; chronic interstitial nephritis.
Wilson[39]	55 yrs.; female	...	Two ureters from kidney	....	.....	Some malformation of uterus	Great size; no lesions.
Crawford[40]	62 yrs.; female	Right	Absent	....	.....	.....	"Large white" kidney; cicatrix in lower pole, result of previous tumor growth (died in coma).
Nelson[41]	20 yrs.; female	Right	Present; 3¼ inches long; closed at upper end	....	Both present and enlarged, especially right	Normal	Relation of vessels normal.
Brinkman[43]	Adult; male	Left	Absent	....	Absent	Left testicle and epididymis small	Decidedly enlarged; 16.5 x 7.5 x 5.5 cm.
Winter[43]	21 yrs.; male	Left	8 cm. long; occluded above	....	Present	Normal	One large and numerous little cysts; little normal kidney structure remaining; death due to nephrectomy.
Edington[44]	2 days; male	Right	.....	Absent	Present and normal	Right vas and epididymis small	Good size, 5 x 3 x 2 cm.; normal shape, though marked lobulation; normal position shows cloudy swelling; atresia anus and hare lip.
Moore[45]	35 yrs.; male	Right	Absent	Absent	Absent; left present and normal	Normal	Considerably enlarged, 285 grams; normal position.
Moore[45]	50 yrs.; male	Left	Absent; right normal	Absent; right normal	Absent; right normal	Absence of genital apparatus on left side	Much enlarged, 480 grams; marked lobulation, otherwise normal in shape; normal position; patient had diabetes and gangrene; died of pneumonia.
Mori[46]	88 yrs.; male	Left	Absent	Artery absent	.....	.....	Large, 16 x 6 cm.
Robinson[47]	...	Left	Absent	....	.....	.....	Compensatory hypertrophy, being one-third excessively developed; normal shape.
Horrand[48]	7½ mos. male	Right	Present; crossed median line and joined left before entering left ureter; was permeable	Absent	Present	Right testicle found in inguinal canal	Lobulated and hypertrophied.
Viannay and Cotte[49]	60 yrs.; male	Right	Absent	Absent	Both present	Absence of right vas deferens and vesicula seminales and corresponding ejaculatory duct; right testicle small; right lobe of prostate somewhat smaller	Compensatory hypertrophy, 250 gms.; normal situation.

Reporter	Age and sex	Which absent	Ureter	Renal artery and vein	Corresponding suprarenal	Condition of genitalia	Condition of existing kidney as to size, shape, position, and lesions present.
Delearde[50]	Young infant	...	.....	....	.....	.....	.....
Hollopeau[51]	50 yrs.; male	Right	Lower portion present, 13 cm. long; permeable and ends in blind pouch above	....	Present and apparently normal	.....	Normal situation; a little larger than normal.
Manson[52]	59 yrs.; male	Right	Absent	....	.....	.....	Large, weight 9 oz.; no pathological change.
Codina[53]	80 yrs.	...	.....	....	.....	.....	Abnormal form and situation; kidney showed changes of chronic nephritis.
Scheuer[54] (Case I)	3½ yrs.; female	Left	Absent	Absent	Present	Normal	Kidney showed amyloid change.
Scheuer[54] (Case II)	60 yrs.; male	Right	Present; and permeable for 1¾ cm., otherwise absent	Artery absent	Present; normal size and situation	Normal	Very much enlarged; on section, cortex found to be thickened; capsule stripped easily.
Scheuer[54] (Case III)	26 yrs.; female	Right	Absent	Absent	Present	Right ovary missing; bicornate uterus, septum extending into bladder	Enlarged, 15 cm. long; capsule adherent; numerous abscesses of kidney, ureter, and bladder.
Scheuer[54] (Case IV)	19 days	Right	Absent	....	Present	Atresia of urethra and anus	Much enlarged, partly due to hyperplasia and partly to hypertrophy.
Broek[55]	Adult; male	Right	Absent	Artery present; vein absent	Present	Absence of testicle, vas deferens and seminal vesicle; right lobe of prostate atrophied	Increased in size, 15 x 8 x 4 cm.; normal position.
Diamantis[56]	60 yrs.; male	Left	Absent	Artery absent	Present and normal	.....	160 gms.; surface smooth and regular.
Jacquin and Marquez[57]	57 yrs.; female	Right	Absent	....	Absent; left hypercystic	Lateral version	Weight 300 gms.; lobulated; normal position; evidence of chronic nephritis.
Schmidt[58]	64 yrs., male	Right	Absent	Absent	Present	Right testicle and epididymis smaller; right seminal vesicle enlarged and is seat of round and spindle-cell infiltration; no spermatozoa present	Shows enlargement, 15 x 6¼ cm.; normal situation; no histological change.
Heiner[59]	40 yrs.; male	Left	Absent	Absent	Present	Tail of epididymis, vas deferens, seminal vesicles and ejaculatory ducts missing on right side; otherwise normal	Slight increase in size due to compensatory hypertrophy; 270 gms.; normal form and situation.
McCrae[60]	49 yrs.; female	Left	Absent	....	.....	Left ovary, tube, broad ligament and left half of uterus absent	Larger; normal position.

Reporter	Age and sex	Which absent	Ureter	Renal artery and vein	Corresponding suprarenal	Condition of genitalia	Condition of existing kidney as to size, shape, position, and lesions present.
Rendue[61]	17 mos.; male	Left	Absent	....	Present; in normal position and form	Normal	Enormous compensatory hypertrophy; 6½ x 5 x 4 cm.; weight 85 gms. (normal 40–45 gms.); globular shape; no macroscopic lesions.
Orbison[62]	31 yrs.; male	Left	Could be traced upward from bladder for a few inches; enlarged	....	Present; measured 2½ x 1¼ in. and was flattened; right like left	.....	No note of vessels; kidney 7¾ x 2½ in.; chronic interstitial nephritis.
Mackie[63] (Case I)	9 mos.; male	Left	.....	....	.....	.....	Weighed 298 gms. and showed fatty change.
Mackie[63] (Case II)	7 mos.; male	Left	Absent	Absent	Absent	.....	Twice normal size, normal shape.
Mackie[63] (Case III)	44 yrs.; male	Left	Absent	....	.....	.....	Large, soft; shows tubercular disease.
Mackie[63] (Case IV)	34 yrs.; female	Right	Absent	Absent	Absent	Both ovaries are fibroid; small fibroid nodules in broad ligament	185 gms.; shows fœtal lobulation, is ellipsoidal; shows some fibroid and fatty change.
Mackie[63] (Case V)	53 yrs.; male	Right	Exists for most part as fibrous cord; patulous for 4 cm. from bladder	....	Normal	.....	Very much enlarged, marked lobulation; shows changes of chronic nephritis.
Mackie[63] (Case VI)	49 yrs.; male	Left	Absent	Absent	Normal	.....	11.5 x 5 x 3.5 cm.; distinct fœtal lobulations; evidence of chronic nephritis.
Mackie[63] (Case VII)	63 yrs.; male	Right	Absent	Both absent	Present; enlarged and softened	.....	Usually thick; 13.5 x 4.5 x 4.5 cm.; shows chronic interstitial change with anemic infarct.
Mackie[63] (Case VIII)	40 yrs.; female	Left	Absent	....	Present	.....	16 cm. in length; pushed upward and forward and is firmly adherent to under surface of liver and diaphragm; shows extensive chronic diffuse nephritis.
Hagner[64]	40 yrs., female	Right	Absent	Absent	Absent	.....	Kidney large, pyonephrosis.
Guthrie and Wilson[65]	30 yrs.; female	Left	Absent	....	.....	Left tube, broad ligament and ovary absent; cervix closed; hematometra; lower end of vagina absent; coitus through urethra	Diagram shows remaining kidney in normal position; size and condition not described.
Anders	64 yrs.; male	Left	Absent	Absent	Left absent; right hypertrophied	Normal	Hypertrophied; weight 240 gms.; surface lobulated, in normal situation; evidence of chronic interstitial nephritis.

The patient is married, has three children, and up until three years ago he was a hard drinker, using on the average about a quart of whiskey and four or five pints of beer daily; otherwise, the social history is without significance.

The present illness began in October, 1908, at which time he noticed shortness of breath and pain across his chest upon exertion; he was easily exhausted, and complained of being constantly tired.

Out of the left eye objects appeared black, and about this time he was compelled to quit work on account of weakness and a feeling of exhaustion. During the previous month, and even subsequently, he passed large quantities of urine (about one gallon per day). In March, he had suffocating attacks, especially at night, and went to the Johns Hopkins Hospital as a patient. Here he was told that he had kidney and heart disease, and remained about five weeks.

Physical examination revealed a middle-aged white male, conscious, rational, though with tendency to stupor, falling asleep during examination; the skin was livid, being especially cyanosed over the extremities; mucous membranes also cyanotic; marked œdema of the ankles and feet, with slight wrist-drop of right arm; head and eyes normal, but nose cyanosed and cutaneous veins engorged; no teeth in upper jaw and only a few in lower; gums showed marked pyorrhœa in lower jaw, but no blue line.

The chest was emphysematous in type, and the respirations were markedly labored. The heart's apex beat was displaced outward; the impulse was short and weak. The right border of cardiac dulness was about 1 c.m. beyond the right sternal edge and the left 1 c.m. to left of the midclavicular line. The upper border was on a level with the third rib. Auscultation revealed a feeble first sound, a soft systolic whiff at apex, with slight accentuation of second pulmonic sound (relative insufficiency). There was some abdominal distention, but no ascites. Liver and spleen were slightly engorged.

On admission, the amount of urine was abnormally small, but after rest in bed, the use of saline laxatives and nitroglycerin, alternated with tincture of convallaria and digitalis, the urinary secretion increased to 64 ounces, while it again decreased during the last few days of life. The pulse was rapid, and toward the close of life compressible, while the respirations ranged abnormally high, particularly during the last four days. The temperature, which had been constantly at a subnormal level until four days prior to death, also became decidedly elevated, touching 104.6° at the time of demise. The physical signs of bronchopneumonia were present during the same period. Repeated urine analyses gave the presence of a heavy ring of albumin and numerous broad granular casts on microscopic examination; specific gravity, 1015 to 1019. The blood pressure in the recumbent posture was, systolic 168, and diastolic 138 mm. Hg.; during his stay in the hospital the blood pressure, however, declined considerably.

The ophthalmoscopic examination, made by Dr. L. Webster Fox, gave this result: Media clear; optic neuritis with marked œdema of the retina, extending back to the equator. The heads of the optic nerves completely buried, and outlines of arteries and veins quite obscured. Striæ of hemorrhages extending completely around the optic nerve entrances; apex of the swellings at least

nine to ten diopters in height. The ophthalmoscopic picture is that of a most pronounced case of albuminuric retinitis.

The patient was sleepless and decidedly breathless in paroxysms at night. Prior to the fatal termination, which occurred April 24, numerous subcrepitant and moist bubbling rales were audible over bases of the lungs.

The *autopsy* was made two and one-half hours after death. No rigor mortis; body still warm to the feel. *Lungs* œdematous; pleural adhesion on both sides (no free fluid); three small areas of

FIG. 1.—The kidney (reduced to three-fourths of its actual size). *A*, enlarged renal artery; *B*, attempt at lobulation; *C*, small retention cyst; *D*, reflected capsule.

consolidation were found—one in left apex, another in the lower lobe of left lung, and still another in the middle lobe of the right lung. These presented the characteristic appearances observed in bronchopneumonia. *Heart* showed general hypertrophy, with considerable secondary dilatation (relative incompetence); weight, 515 grams; valves showed no pathological changes, except slight thickening of the mitral segments. The *liver* was slightly enlarged and cirrhotic; *gall-bladder* normal; *spleen*, apparently normal; *stomach* and *colon*, normal in size and position.

Kidneys. The left kidney, renal artery and vein, as well as ureter, were entirely absent; also the left suprarenal body and

artery could not be found. The right or existing suprarenal body was somewhat hypertrophied. It was observed that the right renal artery was somewhat enlarged, and bifurcated just before entering the existing kidney. The remaining kidney (Figs. 1 and 2) was present in the normal position and much enlarged, weighing 240 grams (8 ounces); it presented a somewhat lobulated appearance. Macroscopically, it showed evidence of interstitial nephritis. The ureter on the right side was also slightly increased in diameter, and on tracing it downward was found to enter the bladder in the normal

FIG. 2.—Longitudinal section of the kidney, showing a thick, somewhat irregular cortex and absence of the section removed for microscopic study (reduced to three-fourths of actual size).

situation. On the opposite side no indication of ureteral orifice was noted. The pelvis of the existing kidney, while proportionately increased in size, did not show the faintest evidence of an attempt at duplication. The genitalia on the side of the absent kidney showed nothing abnormal. The prostate gland was not investigated.

Dr. E. A. Case, the pathologist, reports on the existing kidney as follows: *Macroscopically*, the capsule strips with some difficulty, leaving a granular surface, with one retention cyst, about 3 mm. in diameter. The cortex is not thinned, as in typical interstitial nephritis, but as the man only had one kidney, this fact, and also the

massive size of the organ, are probably thus explained. The cortex is only a bit irregular in thickness. *Microscopically*, the glomeruli show varying changes. Some are larger than normal, with no pathological lesion save a congestion of the capillaries of the tuft. Others are shrunken; still others converted into hyaline masses surrounded by connective tissue. In some the Malpighian tuft has shrunken, leaving an appreciable space in Bowman's capsule. In some of the capsules of Bowman granular debris is to be seen, while others show marked thickening, due to the proliferation of connective tissue about them. The convoluted tubules show parenchymatous degeneration. The epithelial cells are swollen, very granular, outline between them indistinct, and the nucleus stains poorly. In the lumen of the tubules there is considerable granular material. The straight collecting tubules show less parenchymatous change, and many closely approximate the normal. The interstitial connective tissue is markedly increased, being especially marked about the glomerules, but also evident about the tubules. There is also thickening of the arterial walls. In the interstitial tissue of the cortex there is an irregular round-cell infiltration composed of mononuclear cells. The bloodvessels are congested, especially in the region of the collecting tubules and pyramids of Ferrein. It is evident that the material increase in size of the kidney is due principally to a numerical increase of certain anatomical elements. The pathological diagnosis is chronic interstitial nephritis, associated with which is a parenchymatous degeneration.

While this case was not a typical example of urogenital agenesis, it was a true instance of "single kidney," or unilateral urinary aplasia, with total absence of the suprarenal capsule on the same side—a rare and interesting anomaly. It is to be noted, therefore, that it does not lend itself to the investigation of the question of the relation of "single kidney" to anomalies of the sexual organs. On the other hand, the case funished material for a further study of the compensatory enlargement of, and of the various lesions presented by, the existing organ.

Of my own tabulated list of 61 cases, 38 were males, 16 females, and in 7 the sex was not mentioned. The right kidney was missing in 29 cases, the left in 29, and in 3 the particular side was not stated. Of the 38 males, the condition occurred on the left side in 20, and right side in 18. Of the 16 females, the left side showed renal aplasia in 8 cases and the right in 7, while in 1 the side involved was not mentioned. Ballowitz found the condition on the left side oftener than on the right in the male, the ratio being 70 to 42, while according to my figures the proportion was about even, or 20 to 18. In the female, both sides are about equally affected, according to my figures (vide supra).

The ureter of the side of the congenital aplasia was absent in 42, present to a greater or less extent in 9, and in the remaining 10 no

mention was made. In 8 cases the genitalia were normal, in 19 abnormal, and in 34 instances their condition was not described. Of the 19 in which the genitalia showed hypoplasia, 11 were met with in the male and 7 in the female, while in 1 the sex was not stated. The precise character of the defects are briefly described in the tabulated list of cases, and it will be observed that they are remarkably variable, both as to degree and nature.

The suprarenal gland could not be found in 11 instances, was present in 26, and not referred to in 24. It was missing seven times in the male and four times in the female; or, in other words, in nearly even proportion in comparison to the totals for the two sexes. The renal artery was reported absent in 24 cases, present in 3, and unmentioned in 34.

The number of cases showing renal changes in the remaining organ other than mere hypertrophy was 27, those showing only hypertrophy, 7, while the renal changes were not described in 27. There were 15 cases, or 55 per cent. of the total number in which the lesions presented by the kidneys were described, that showed chronic nephritis, of which 8 were of the chronic interstitial variety. The findings in 3 cases were those of chronic parenchymatous nephritis, while 1 case presented the lesions of acute nephritis. Two patients showed tuberculous lesions, and 2 pyonephrosis; 3 had died of chronic diabetes mellitus. A single instance was furnished by each of the following conditions: Hydronephrosis, "abscessed kidney," calculus (ureteral), cystic kidney, congested kidney amyloid kidney, and fatty kidney.

A similar consideration and analysis of all of the reported cases of solitary kidney in which the points at issue are detailed, or 286, gives us somewhat different and also more important generalizations.

Sex. In 248 cases the sex was mentioned, of which 159 were males and 89 females. As stated by Ballowitz, it is to be recollected that autopsies are less commonly made in the latter than in the former sex.

Age. Of 154 cases in which the age at death was given, 34 patients were under ten years; this number, however, includes 13 premature births. Between the tenth and fiftieth years 62 cases occurred, and after the fiftieth year 58 cases. Included in my series there was 1 case which had reached eighty-eight years of age, and another eighty years. These figures would indicate that longevity is not markedly abridged by the occurrence of this condition.

Side. Out of 286 cases, the condition occurred on the left side in 153, and on the right side in 120, with 13 not differentiated. In 158 males the congenital urinary aplasia occurred ninety-six times on the left side and sixty-two on the right. Per contra, of 83 cases occurring in the female, the left kidney was missing in 40, and the right in 43. It would appear, therefore, that the proportions for

the two sexes are diametrically opposed, but I am not in a position to offer a satisfactory explanation for the differences in sexual influence upon the side involved.

Out of the whole number, or 286 cases, the ureter was completely absent in 248. In 24 instances a more or less rudimentary ureter was in evidence, without the slightest indication of the presence of renal structure.

The presence or absence of the suprarenal gland was noted in 151 cases; it was present in 109 cases and absent in 42, or 27.8 per cent. In 14 cases the suprarenal gland on the side of the absent kidney was enlarged; in 2 it was atrophied. It is interesting to note that the suprarenal gland on the side of the existing kidney is rarely enlarged; for example, this was the case in 5 of the 61 cases included in my table, and in only 2 out of 111 cases tabulated by Ballowitz. In a single instance this organ was smaller than normal on the side of the remaining kidney. The condition of the genitalia was noted in 135 cases (out of the grand total, or 286), of which, 94 showed congenital defects, and 41 were obviously normal. Among the cases of genital hypoplasia were 40 males and 49 females, with 5 sexually undifferentiated.

It was found that 79 cases out of the grand total, or 170, in which the renal changes were given, or 46.5 per cent., showed morbid lesions other than mere compensatory hypertrophy. Among these 79 cases were: Chronic interstitial nephritis, 19; chronic nephritis (variety not specified), 11; chronic parenchymatous nephritis, 2; ureteral calculi, 9; pelvic calculi, 6; pyelonephritis, 10; cystic kidney, 3; tuberculosis, 2; hydronephrosis, 4; "diseased" kidney, 3; stone in the bladder, 1; carcinoma of kidney, 1; "cloudy swelling," 1; congested kidney, 1; amyloid kidney, 1; fatty kidney, 1; and abscess of kidney, 1.

Ballowitz speaks of the frequent occurrence of nephrolithiasis being emphasized by the older writers, and Mosler[66] refers to the danger to the individual attending disease processes affecting single kidney. The results of the combined statistics of Ballowitz, Moore, and my own indicate clearly that a greater than the normal percentage among subjects of congenital single kidney die of kidney complaints, as will be shown hereafter. Unquestionably nephrolithiasis is attended with peculiar danger to life in cases of single kidney in which the stone occludes the ureter. Obviously an effort should be made to remove promptly the calculus when single kidney is known to exist, after locating it by means of radiography. Indeed, the condition calls for unusual promptness if it is expected to save life. Obstruction of the ureter by a calculus has occurred after nephrectomy, and has been relieved by timely nephrotomy. Complete occlusion of a single ureter tends to the development of uremia, ending in death. The operation should be done at the end of forty-eight hours if spontaneous relief is not afforded.

Says Ransohoff,[67] there are records of eleven operations of solitary kidney—four nephrotomies and seven nephrectomies. The nephrectomies were fatal in from one to eleven days. The patient of Polk[68] lived eleven days. Traumatic rupture of a solitary organ caused death (as was to be expected) in a case reported by Taylor.[69] It is important to recollect that the ureteral orifice is generally absent on the side of the missing kidney. It follows that under these circumstances the condition under consideration is demonstrable by means of a cystoscopic examination; this should be, however, supplemented by catheterization of the ureters in cases in which two ureteral orifices exist, since in a small percentage of the cases of congenital single kidney a rudimentary ureter is present, extending upward from the bladder for a variable distance. It is highly probable that in a certain proportion of the latter instances, at least, the catheter could be introduced into the ureter for a short distance, but, obviously, not any urine could be segregated.

The importance of single kidney from a surgical standpoint can scarcely be overemphasized. The subject is also of special interest to the pathologist and internist, as shown by the fact that the advanced lesions of chronic nephritis were found in 32 of the fatal cases, or 42.3 per cent. Finally, it cannot be doubted that the development of either acute or chronic nephritis in cases in which renal agenesis exists gives a less hopeful outlook than when these arise under normal conditions, that is, bilaterally.

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THE TREATMENT OF RHEUMATIC FEVER.[1]

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Theories of Rheumatism. It is not my purpose to discuss the numerous theories advanced to account for the phenomena of acute rheumatic fever. I will merely state that it is the consensus of opinion at the present time that the disease is an acute infection. Numerous observers have claimed to have isolated the specific organism, among the most insistent of whom are Poynton and Payne. To the former has been lent the weight of the authority of Osler's new *Modern Medicine*, to the pages of which he contributes the article on rheumatism, and in which the various views of the etiology of this disorder are set forth in some detail.

Age. About one-half of all cases of rheumatism occur between the ages of fifteen and twenty-five years; about one-quarter in the next decade, that is, between twenty-five and thirty-five years. My own impression, based on considerable contact with children, is that the figures set for childhood are too low, as the disease is peculiarly insidious at this age, and deviates strikingly from the type as established in the adult. The serious complications are quite as common, even more common than in the adult. Of the cases occurring in childhood, 70 per cent. fall between the ages of ten and fifteen years.

I cannot refrain from intercalating a bit of pediatric wisdom at this juncture: (1) Beware of a diagnosis of rheumatism in infancy. It is so rare that, when authentic, it warrants rushing into print, which is saying a good deal. The so-called rheumatic joints of infancy are almost certainly pyogenic, scorbutic, or syphilitic. (2) Scan every child's heart with care, and seek constantly in the histories for tonsillitis, stiff neck, and especially "growing pains." How many children's lives have been sacrificed to that unfortunate term no man can estimate.

Symptomatology. That the disease is rather abrupt in its onset, accompanied by fever, that sore throat is not uncommon, that drenching acid sweats may occur, and that the inflamed joints are the pathognomonic sign, is all well known, and is reiterated here merely to emphasize the points of attacks in the application of therapy. The complications are the important events in the course of rheumatism, and will be considered after rules have been laid down for the simple, uncomplicated case.

[1] A lecture delivered at the Cornell University Medical College, New York.

THERAPY. A sick man invites medical attention for two reasons: First, he wants to be cured of his disease; and second, he wants to be made more comfortable during his illness. To treat a patient intelligently, it goes without saying that a diagnosis is imperative, but the intellectual satisfaction derived from establishing a diagnosis must not lead to a satiety that eschews further effort directed toward relief of the condition. Such a comment is justified by fact. Still another function to be subserved by the physician is the instruction of the patient how to avoid a repetition of the attack. There are certain measures that may be directed toward any acute illness, others that are aimed at the particular disease in question. This order will be preserved.

Rest. In the rheumatism of adults the painful condition of the joints impels rest, willy-nilly, but this by no means obtains in children. Pain, which he who suffers it looks upon as an unmixed evil, is more often a boon than a bane. If one will get in the habit of analyzing the symptoms of disease in terms of efforts on the part of Nature to accomplish a useful purpose, or as expressions of compensations, he will be amazed to see how many hints these symptoms give that they are to be utilized as allies, not combated as enemies.

In rheumatism there are three emphatic reasons why rest should be insisted on: (1) Because the body cells are busied in combating an intoxication, for which their energy should be conserved as much as possible; (2) because certain tissues are undergoing the alteration incident upon inflammation, and are struggling to accomplish repair; and (3) because the spectre of cardiac involvement is never absent from the disease, and we fear that every increment of activity on the part of that organ may heighten the possibility of the dreaded disaster.

To illustrate the significance of rest, I will cite the following figures: One knows, as a fundamental physiological fact, that the energy and heat of the body are derived from the combustion of the foodstuffs, and that the carbon of these foodstuffs is in large measure eliminated from the body through the lungs as CO_2; so we can collect and estimate the amount of CO_2 eliminated in a unit of time, and look upon the results as expressions of the activity of the body cells during that period. This has been done repeatedly, and the same individual who during sleep eliminates 22 grams of CO_2 per hour will, when awake and exercising the greatest amount of muscular relaxation possible, eliminate 31 grams, and under conditions ordinarily considered those of rest, 38 grams. In this light, rest assumes a meaning, and the importance of restlessness and loss of sleep in disease is enhanced in dignity.

The two important factors to be considered in estimating the amount of work done by the heart are the amount of blood expelled and the pressure, that is, resistance, to be overcome. The lessened

heart rate in recumbency and the diminution, even though moderate, of blood pressure in this attitude will suffice to emphasize the importance of rest to this organ.

Rest should be in bed. One might suppose this injunction to be superfluous, and yet it is everyone's experience not infrequently to find himself in the presence of contentious individuals who demand many reasons, when it might be supposed common sense would dictate; and one might as well write in golden letters on the tablets of his memory that he is to treat individuals, whose very individuality depends on differences, not machines nor yet diseases.

Bed. The bed should be of a height and width most convenient for handling the patient, who is in many instances helpless, and to whom the most gentle handling may constitute torture. A half, or at the most three-quarter bed, with a woven wire spring, sufficiently stiff to prevent sagging, should be chosen. The standard hospital bed is an admirable example. The mattress should be soft, but resilient and firm. A good hair mattress is preferable. If the patient perspires freely, the bed should be made with thin blankets instead of sheets. The patient should wear a thin flannel nightgown, opened all the way down the front and slit along the sleeves, so that the joints may be exposed for inspection or treatment with the least disturbance, and it is well to throw a thin flannel cape about the shoulders. The nurse should be instructed to put the clothes on this bed with a view to the comfort of the patient, rather than to preserve the symmetrical and esthetic effect so often insisted on in the hospital ward, regardless of the comfort of the patient. Often the lightest touch of the clothes is agonizing to the patient, and hoops, cradles, or other contrivances to take the weight of the clothes off the patient must be utilized.

Room. The best available room should be chosen, with a view to an abundance of light and air, with a southern exposure in the winter, and away from the prevailing winds at all times. The bed should be so placed that the draughts may be avoided but the air not shunned. The therapeutics of light is not duly appreciated. The minds and bodies of many of us are as responsive to its influence as a photographic plate. I hope on another occasion to go more into detail about this matter. Air should be admitted to the room freely. There can be no superfluity of fresh air. In summer the windows should be kept wide open. In the winter the room should be frequently aired and kept at 65° to 70° F. Personally, I do not hesitate to admit the cold clear air of a winter's day to the sick room, observing proper precautions with reference to the patient's coverings.

Diet. If there is any one field within the province of medicine that promises richer yield than another for the labor expended on it, it is that of dietetics. As yet it is almost virgin, and still such results as have been obtained are of the highest significance. It

has been well suggested that if the physician would give the same amount of time, work, and care to the prescription of foods that he does to drugs, enormous benefit would accrue to his patients.

In the first place, a sick man needs food, and he needs more food than is ordinarily given him. Of course, one grants that there are certain conditions that make the administration of sufficient food difficult or impossible, but that does not obtain in the majority of instances. As I have said, the energy and heat of the body are derived from the combustion of its foodstuffs, and as energy can be converted into heat, the value of the foodstuffs can be expressed in heat units. Moreover, the amount of energy and heat the body gives off in a day can be measured in terms of heat units; so that we can determine just how much food an individual of a given weight, under varying conditions of activity, needs. The term adopted to express a heat unit is the "calorie." The amount of heat that 1 calorie represents is that required to raise 1 kilogram of water from 0° to 1° C. This calorie is sometimes spoken of as the "large calorie." The "small calorie" is the amount of heat needed to raise 1 gram of water through 1° of heat; therefore, 1 "large calorie" equals 1000 "small calories." Unless qualified, the term "calorie" means a "large calorie."

Now, under what is ordinarily known as rest, a man gives off heat in twenty-four hours equivalent to about 33 calories per kilo of body weight; that is, a man weighing 70 kilos, or 154 pounds, will give off about 2300 calories. This amount of heat must be replaced by his foodstuffs to keep him in equilibrium.

The patient with rheumatism, however, is suffering from fever, and in fever he gives off not only what he does in health at rest, but some 20 to 30 per cent. more. If we add 25 per cent. more to our estimated calories at rest, we find the patient's needs are 2800 to 2900 calories. We are all aware that in febrile conditions it is customary to put a patient on a milk diet, because the different food constituents—fat, carbohydrates, and proteids—are so well represented in it, because it is bland, and because it is easily administered. The physician's instructions frequently are a glass of milk every two hours. A glass is supposed to hold 8 ounces; more commonly, as given, it holds 6 ounces. On this schedule, ten feedings would be exceptional, and eight nearer the actual number; so the patient would get 1½ to 2 quarts of milk a day. In a quart of milk there are 620 calories of food; in the patient's dietary, 930 to 1240 calories, or one-third to two-fifths of his needs as calculated. But the case is even worse than this, for, as I shall later show, there are reasons why, in fever, a patient's dietary needs are greater than those set out above.

It is an easy mathematical problem to determine that to meet the patient's needs with milk would require some 5 quarts of milk, and the administration of over a gallon of milk day after day does not

appeal to our common sense. To keep within quantitative limits, qualitative changes must be made in the food. The readiest way to do this is to add to milk, cream to furnish more fat, or starch, or sugar, to furnish more carbohydrates. For example, enough milk sugar can be added to the milk to make 10 per cent. without making it disagreeably sweet; or cereals, to make gruels or milk soups. Six per cent. of sugar added to milk will give a milk equal to about 860 calories to the quart.

In addition to milk, cereals, bread and butter, rice, and cereal or milk soups are permissible. An ordinary thick slice of white bread (1½ ounces) furnishes 100 calories; an average pat or ball of butter (a little less than ½ ounce) the same; an ordinary helping of boiled rice (4 ounces) as much more, and 1½ ounces of cream the same. Even 3 teaspoonfuls of granulated sugar affords 100 calories. There are 100 calories in a large serving of oatmeal or hominy.

This necessity for a sufficient diet obtains especially in long-continued fevers, while in the brief fevers of intense character, in which the functions of the digestive organs are impaired, only small amounts of food are to be urged, as the body has a surplus to meet its needs for a short time.

I have introduced these figures thus early to concentrate attention on a branch of our art that has been left too little cultivated and exercised without reason. Milk, milk soups, cereals, bread, and rice form the staple diet in rheumatism. To meat soups, which have scarcely any nutritive value, there are certain theoretical objections, but if their well-known influence in spurring a jaded appetite and stimulating what the Germans call the "appetit-saft," is taken into consideration, I think their administration in small amounts is warranted. With the decrease in the fever, eggs may be used, and in convalescence, fish, meats, and vegetables.

Bowels. When called to attend a patient suffering from an acute infectious process, it is a good rule to assure satisfactory evacuation of the bowels. Just how much additional disturbance a neglect of this measure may induce we do not know, but we are aware of the fact that at times in an individual otherwise well, constipation may incite symptoms akin to acute intoxication, or more commonly, depression, malaise, anorexia, and headache, and we have evidence that products of decomposition in the bowel, normally absorbed and paired, like the indol group, with sulphuric acid, can, when this function of pairing is interfered with in disease, give rise to toxic manifestations.

An active saline, like magnesium sulphate or Epsom salts, sodium sulphate or Glauber's salts, or sodium potassium tartrate or Rochelle salts, in doses of 1 ounce, or, in patients susceptible to saline purgatives, ½ ounce, may be given, assisted by a soapsuds enema four to six hours later, if the salts have not been sufficiently effectual.

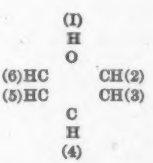
It should be remembreed that the feces represent an excretion

from the bowel of mucus and other substances which represent nitrogenous metabolism, and afford a pretty constant percentage of the total nitrogenous output; that the feces are not mere food residues, and, in fact, normal feces should contain but very little food residue other than indigestible fibers of cellulose, seeds, etc. Hence it is surprising to the patient, and often to the physician, too, to discover so large results from catharsis when the patient has been on a milk diet, or even when on no diet at all. With this knowledge, then, of the formation of feces with a low or easily digestible diet, the necessity of attending to periodical evacuation is emphasized. This may best be done by enemas in most febrile diseases, but with the discomfort incident upon handling any of the body in rheumatism, further doses of salines may be preferred. I believe that too frequent catharsis by drugs entails an irritation that in itself may become mischievous.

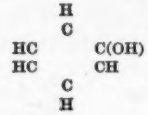
Specific Treatment. It was once hoped that every disease might be met by a specific drug, and it was once believed that many diseases were cured by specific drugs; but as medicine entered on an era of more searching observation, and had to rest its judgment on scientific criteria, the number of specifics dwindled, until specific treatment has come to connote the treatment of one disease alone.

When Dr. Maclagan, of Edinburgh, in 1874, began to use salicin, a glucoside of salicylic acid obtained from the young bark of the willow, in rheumatism, which was quickly followed by the introduction of other forms of salicylic acid, the change that came over the clinical picture of this disease, that turned a bed of racking pain into a couch of relative comfort in a few hours, and a patient to whom the least touch was agonizing into one who could be handled with relative impunity, warranted the belief that a specific had, indeed, been discovered. It is said that we no longer see rheumatism as it was presented to the older practitioners, and yet the drug can not be called specific, if we mean by that one that can eradicate the disease. That its discovery was a boon, no one who has witnessed its effects can for a momnet doubt.

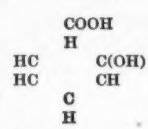
Salicylic acid has this structure:



is the benzine ring. If you will replace the H at (2) by an –OH group, that is, make an alcohol of it, you will convert it into a well-known poison, carbolic acid.



Note what slight changes in a complex group and the introduction of what simple radicles induce potent changes in character. We have but to make another slight change, by introducing an acid radicle at (I), to convert the toxic carbolic acid (which is no acid at all, but an alcohol) into the substance in question, salicylic acid.[2]



I might add that the introduction of an acid radicle into the structure of a toxic alcohol detoxicates it. This is a general law.

This substance is classed among the antipyretics and antiseptics; it is also an anodyne. Its therapeutic value is exercised in all three directions in rheumatism. Salicylic acid may be administered as such, or in the form of a salt or ester. The effect is the same in kind in all these forms, but certain by-effects determine the use of one or the other. It should be administered in full dose. Its failure may often be attributed to insufficient dosage. Its toxicity is slight. In an adult of average weight I give as much as 20 grains of one or the other form of the drug every two hours for the first twenty-four hours during the waking period, or even for forty-eight hours. In severe cases even 30 grains may be given for the first two or three doses. When the pain subsides the dose may be cut down gradually to 15, to 10, to 5 grains at a dose, how much and how rapidly depending on the progress of events or on signs of accumulation. The dose should be well maintained at amounts of 10 grains every two hours until the active phases, as evidenced by fever, pain, and joint swelling, have passed. Just how this drug acts in rheumatism we do not know, but its effects are so much more prompt and satisfactory in this condition than in any other clinically akin to it, that we are impelled to believe that it has some effect on the materies morbi directly; so that it is my custom to keep the patients on considerable doses—5 to 10 grains every two or three hours for a week or ten days after the subsidence of acute symptoms, and for four to six weeks on lesser doses of 5 grains three or four times a day, administering the drug much as we do quinine in malaria.

[2] Salicylic acid is not derived in this manner, but from ortho-oxy-benzyl alcohol $HO.C_6H_4.CH_2OH$. The illustration is used to draw attention to the chemical kinship of well-known drugs which are so different in their action.

Disagreeable symptoms sometimes ensue; more often disagreeable than dangerous. They are: (1) buzzing, roaring in the ears, with varying degrees of deafness; (2) gastric disturbances; (3) cardiac disturbances; (4) respiratory disturbances; (5) cerebral symptoms; (6) renal complications; (7) hemorrhages; and (8) skin involvement. This looks like a formidable array of disasters, and so do tidal waves, cataclysms, and the fall of meteors in the catalogue of everyday possibilities; but, like most apparitions, this list takes less substantial proportion when submitted to light. I will consider them in the reverse order. Skin eruptions after the use of the salicylates are rare; still a diffuse erythema, an urticaria, a hemorrhagic outbreak, and other forms may follow. It will be observed that the three forms specified have all been associated with rheumatism, and it would be difficult to determine in all cases the association of the drug with the rash. They are not dangerous in themselves, and the drug should not be intermitted on their appearance unless clearly aggravated by the continuance of the drug.

Retinal hemorrhages are still more uncommon, while epistaxis has been more frequently reported, and, if severe, might enforce cessation of the drug. Albuminuria and hematuria, which have been attributed to the irritating effects of salicylates, may be caused by the disease itself, but with their appearance it might be wise to intermit the treatment until it is demonstrated that they do or do not play a part in the disturbance. There can be no doubt that now and then the salicylates have induced an active delirium, sometimes like an acute mania. I recall a report of two such cases occurring at Bellevue Hospital, but it is very unusual. It must not be forgotten that delirium intervenes in the course of rheumatism, especially, it is said, with the onset of a pericardial involvement, and associated with hyperpyrexia. Dyspnœa, characterized by slow and labored breathing, has occurred, and suggests the possibility of impurities in the drug, as, indeed, does the slow heart and threatened collapse occasionally noted. Here, too, one must keep in mind the involvement of the myocardium in the disease. However, in either instance, so threatening a condition should indicate a withdrawal of the drug.

To sum up, I should say that the above-mentioned conditions are rare; that they may be attributable in some instances to the disease rather than to the drug, in other cases to impurities in the product used, and finally, to idiosyncrasies—that peculiar reaction of the individual to drugs, food, and environment that takes him out of his class and constitutes in him an anomaly, and defies foreknowledge. I firmly believe that it is only a minority of the above-mentioned conditions that can be attributed to the drug itself.

It stands otherwise with the first two disturbances enumerated. They are to be attributed to the drug, and their occurrence modifies

our action. The ringing in the ears and a mild grade of deafness may be looked upon as a limit of tolerance with comfort rather than a menace. There is no reason to intermit the drug on this account, but if the discomfort is considerable, the dosage should be cut down. The gastric irritation resulting upon the administration of salicylates is the *bête noir* of the practitioner. It is for this reason rather than for any other that so many forms of salicylates are in use. There are certain forms of the drug from which one may anticipate more irritation than from another, but, again, the susceptibility of a particular stomach to a particular preparation cannot be predicted with any degree of assurance.

I advise, as a rule, the use of the preparation that has stood best the test of time and experience. In this case it is the sodium salt of the acid. I may say at once that the acid itself is too irritating to administer internally over a length of time. Order the drug alone, in simple solution. Do not fall victims to polypharmacy. Good polypharmacy is an art that few attain, if, indeed, it is attainable. The polypharmacy that most of us practise label us as copyists. Be sure that the drug is chemically pure. There are two ways of attaining a pure drug: First, specifiy the chemist's, that is, manufacturer's name; second, send the patient to a druggist whose honesty is his commercial success. Unless this precaution is taken a cheap synthetic sodium salicylate, contaminated with the by-products of its synthesis, may be used, and to these impurities may be attributed much of the gastric irritation and other toxic manifestations of the drug. Order the dose to be taken well diluted.

For example, write thus:

℞—Sodii salicylatis 15.0
Aquæ destillatæ . . . . . q.s. ad 60.0
M. et S.—One teaspoonful in water every two hours.

One will note that this calls for a 2-ounce mixture, but is written in the metric system, and that there are just as many grams in this 2-ounce, or 60 c.c., mixture as I want to give grains in one dose. Even the water has as many cubic centimeters as I want to give drops in a dose—60, that is, 1 teaspoonful.

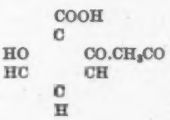
Sometimes the salt is better borne and less disagreeable to the taste if a little glycerin is used, as:

℞—Sodii salicylatis 15.0
Glycerini 15.0
Aquæ destillatæ . . . . . q.s. ad 60.00
M. et S.—One teaspoonful in water every two hours.

If one has doubts about his patient's ability to get a good salt, he should order the salt made fresh from salicylic acid by adding sodium bicarbonate. This is a very excellent way of writing the prescription:

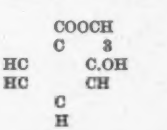
℞—Acidi salicylici 15.0
Sodii bicarbonatis . . . . . q.s.
Aquæ destillatæ . . . . . q.s. ad 60.0
M. et S.—One teaspoonful in water every two hours.

The druggist is to use of the soda what is needed; he adds definite proportions of the two drugs, if he follows the Pharmacopœia, or he simply adds soda to the solution of the acid until effervescence ceases, that is, until no acid is left to liberate the CO_2 from the soda. If, for any reason, sodium salicylate is not well borne, one may have recourse to another form of the drug. My own preference is for aspirin, which is an acetylsalicylic acid; that is, it is salicylic acid in which the H of the OH group has been replaced by an acetic acid radicle, CH_3CO; thus:



This substance is a white powder, formed of small crystalline needles, practically insoluble in water (100 parts) and in acids, so that it passes through the stomach for the most part unchanged, and is broken up in the intestine. It is less irritating to the stomach, but that it should be devoid of all the disadvantages of the sodium salt its chemical structure forbids us to believe. I have in one instance seen a massive angioneurotic œdema of the face follow a single small dose, and have seen three such cases reported in the literature since. However, I believe it to be a very valuable form of salicylic acid. It is best prescribed in capsules. The dose is practically the same as the sodium salt, or about 15 grains for a beginning dose.

Another excellent preparation of the salicylic acid series is the ester, methyl salicylate, that is, salicylic acid in which the H of the acid group is replaced by methyl CH_3; thus:

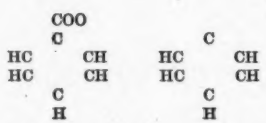


Methyl salicylate is a volatile oil that constitutes well over 90 per cent. of the oil of wintergreen, the well-known gaultheria procumbens of our woods, and of the oil of birch, oleum betulæ, obtained from the bark of the sweet birch, betula lenta, or is produced synthetically, and when carefully prepared should answer the purposes of the natural oils. Of the three, the oil of wintergreen is, as a rule,

preferred. It may be given in capsules, in emulsion, or in milk. I very much prefer the capsules, because in emulsion the decided taste of the drug, which may be agreeable at first, soon palls on the patient.

As for its administration in milk, the same objection obtains, and what is much more important, it violates a rule that I believe one should invariably observe—never give medicine in food, for, if the medicine does disagree, its association in the mind of the patient with the food may produce a disgust for food which may be the mainstay of the case. The drug is usually very well borne, but its decided taste, even when given in capsules, for the slight eructations it often induces is a constant reminder, is the chief drawback. One will rarely have to choose outside of one of these three forms of salicylic acid in the treatment of rheumatism. If he does, the great probability is that he has not administered these forms properly, or that the patient cannot stand salicylic acid in any form, or that the series does not meet the needs of this particular case.

I will mention two other well-known preparations: First, the original drug, salicin. This is a glucoside, which can be split up by acids into grape sugar and saligenin, the active principle, which is the alcohol from which salicylic acid is formed, and this formation of the acid goes on in the body after its administration. It is a white powder, bitter to the taste, rather insoluble in water (28 parts), so best administered in capsules. It is well borne, and by many preferred for children. The dose is the same as for the others. Second, salol, another ester, phenylsalicylate, that is, salicylic acid in which the H of the acid group is replaced by phenyl C_6H_5; thus:



It is a white powder, almost tasteless, and quite insoluble in water. It passes through the stomach for the most part unchanged, and is broken up in the intestine, two-thirds of it appearing as salicylic acid and one-third as carbolic acid. It is administered best in capsules or powders, or can be suspended in mucilage of acacia. It has no advantage over the other forms in rheumatism, and has the disadvantage of affording only two-thirds of its weight as the desired substance, while one-third is the toxic carbolic acid, which can produce its characteristic poisonous symptoms when given in large doses. The dose is about the same as for the other preparations.

As I have already intimated, some patients cannot take salicylic acid in any form. We cannot, for that reason, neglect their need for

relief of pain. The three drugs in most common use for such a purpose are acetanilide (antifebrin), antipyrine, and phenacetin (officially acetphenetidinum). Of these three, the first is the most potent, also the most irritating and toxic. These drugs are not given over a long period, as the salicylates are, but as needed, to control pain. Often small doses, frequently repeated, are as efficacious as fewer large doses. Acetanilide may be given in doses of 1.5 grains every half hour for four doses, or 2 to 3 grains every two hours. If there are heart complications, it should not be used. Phenacetin may be used in twice the dose. The dose of antipyrine lies between the two. These drugs should be promptly stopped if cyanosis appears, which is well before cardiac or respiratory failure threaten, and, of course, as soon as pain is relieved.

If the pain is severe, rather than push these coal tars to large doses, one should use morphine, in small doses, hypodermically, $\frac{1}{16}$ to $\frac{1}{8}$ grain. Morphine in any illness of length should be used reluctantly and in minimum dose, lest a habit be established. Two other drugs have been much used to control pain—potassium iodide and colchicum. Their bad effects on the stomach are too certain, and their beneficial effects on the condition too dubious, to encourage their use.

Another line of treatment, originated in England by Fuller to combat an acidity that at that time was looked upon as an etiological factor in the disease, is the "alkaline treatment." This treatment met with little favor elsewhere in Europe, but was adopted in this country to a considerable extent, and still has considerable vogue. By many men it is used when the salicylates are not well borne; by others when cardiac complications threaten or exist; and by a very great many in conjunction with the salicylate treatment. In my own opinion the treatment has been dictated more by tradition than by manifest evidences of its efficacy, as in the case of the salicylates, and yet I am not prepared dogmatically to negative the judgment of so many good observers. One should choose the milder alkalies—sodium bicarbonate, potassium citrate, or potassium acetate; for example, 20 grains of sodium bicarbonate every two hours until the urine reacts alkaline, and then every three hours, or in a little less dose, or enough to continue the urine alkaline. Those who are enthusiastic in its use claim that cardiac complications are less likely to ensue, or, if occurring, they are less severe.

Symptomatic Treatment. The symptoms that give character to this disease are those referable to the joints. The improvement in the local manifestations of the disorder under salicylates constitutes one of the most satisfactory evidences of their potency, and yet the resolution of these parts often lingers well behind the disappearance of the fever and the pain; and, moreover, much can be done during the height of the disturbance to ameliorate the discomfort, hasten the resolution, and prevent bad sequels.

Rest. For an inflamed joint, just as for a broken bone, rest is imperative. Pain, which I have said is Nature's agent, impels rest, but when pain is banished or mitigated under our ministrations, the patient uses the joint too early, and often to his great detriment. The position of the limb in semiflexion is one involuntarily chosen as the most comfortable, and may be preserved during the acuteness of the attack. Various devices are used to maintain a single position. We can bolster the limb by putting pillows under the knee or on either side, and find similar arrangements for the other joints. This, of course, can not assure a high degree of immobility, and we can secure better results with splints, well padded and carefully applied. The success of these devices depends on the care and skill with which they are applied, and if simply suggested by you and left to the devices of unskilled hands in the application will be far worse than useless. Still another way to attain the desired end is by applying stiff bandages of plaster-of-Paris or starch. Again, much care must be taken in the application, as the parts cannot be daily inspected, and rough folds in the bandage, bits of dried plaster next the skin, which is moist with the excessive perspiration, can induce sores of serious import. These casts must be reapplied as the effusion in the joint disappears. On the whole, a good splint is, I think, the best device.

Heat and Cold. The patient's testimony is sufficient evidence of the comfort these measures afford, whatever opinion may be entertained with reference to their curative qualities and the rationale of their action. From the standpoint of comfort the reaction of different patients to heat or to cold differs widely. To one patient, with a painful joint, cold gives almost instant relief, while in another the pain is intensified, and finds relief from heat, and vice versa. Continuous cold exercises considerable anesthetic effect, and may be secured by the application of the ice coil, or the more readily obtained and manipulated ice bag. Ice bags of various shapes may be obtained, but the circular ice bag does well for most purposes. The ice bag must be properly filled in order to make its application efficient. The ice should be cracked in pieces not larger than the end of one's thumb, and enough to cover the bottom of the bag. Enough cold water is poured on this to enable one to force all the air out of the bag and screw the cap down to the level of the water. This procedure leaves the bag supple, so that it may be wrapped around the part, which the presence of air makes impossible. Protect the part with a thin layer of vaseline or oil and a thin layer of cloth. A long-continued direct application of ice to the skin may do damage to that structure. Heat is best applied by fomentations. A couple of layers of flannel are wrung out of boiling water in a wringer made of a crash towel, and applied snugly to the joint. This is repeated three or four times, at intervals of ten to fifteen minutes. The parts are then sponged with water at about

75° F., and wrapped in flannel or non-absorbent cotton. A soothing application is the cold compress. This is done by wringing two or more layers of linen or old cotton cloth or cheesecloth out of water at about 60° F. and applying snugly to the part. This in turn is covered by dry flannel. These applications are renewed about once an hour. The effect of cold is momentary; the vessels soon dilating and conveying heat to the surface, warm the compress to the temperature of the part drying it. The reaction induces a hyperemia, the value of which will be touched on at some future time. The joints should at all times be well protected from changes of temperature. This is best done by wrapping them in layers of non-conducting material, like flannel or non-absorbent cotton or cotton batten. The number of drugs that have been used locally are legion. I will purposely refrain from mentioning more than one or two that I have found helpful. Perhaps the most common application is methyl salicylate. That it does any more than any other volatile oil, by inducing a hyperemia, I doubt. That the salicylates may be absorbed by the skin I have proved to my own satisfaction, but not in such amounts as to make that the object of the application. The methyl salicylates may be applied pure, or in the form of an ointment. The following is one in much use:

℞—Methyl salicylatis,
Menthol . . . . . ää 15 per cent.
Petrolati . . . . . q.s. ad 1 oz.

An ointment containing ichthyol has been much praised. For example:

℞—Ichthyol . . . . . 25 per cent.
Petrolati . . . . . q.s. ad 1 oz.
M. et S.—Local use.

Counterirritation. Counterirritation is a very old remedial measure, which has survived the rise and fall of countless therapeutic efforts, and the very persistency of which, in this Nihilistic age, speaks for its reality. It is indicated rather in the subacute or chronic stages of joint inflammation than in the acute. Of the many means of inducing it, I will mention two only as worthy consideration—the cautery and the fly blister. Of the two, the former is much the better, as being easier of application, easier of control, less likely to be followed by bad results locally, and entailing no danger from absorption. The cautery is flicked lightly over the part, care being taken to avoid severe blistering or deep burns. The part is then smeared with vaseline, oil, or ointment.

In applying the blister (ceratum cantharadis), it is cut about one inch square. In making the application to the knee, four such might be used, one above and one below on either side. Shave and cleanse the part. Oil the edges of the blister and apply a little

vaseline to the skin adjacent to the blister, to avoid its spreading. Leave the blister in position for four to six hours, and if a blister has not formed in the skin by this time apply a warm poultice to the part, which will hasten its formation. Puncture the blister on its dependent edge, evacuating the serum but not destroying the protecting epithelium. Dress with oil. Some of the disadvantages of the blister have just been set forth, and in the presence of a damaged kidney, as may occur in the course of rheumatism, the dangerous irritating effect of this drug on the parenchyma of the kidney, which it causes in the course of its excretion, must be kept in mind.

Pressure. When an effusion is slow to absorb, one may hasten the result at times by applying a snug bandage of flannel or rubber, which will exert a continuous but moderate pressure.

Later Measures. As the disease is prolonged, chronic changes in the joints threaten. Care must be exercised to prevent ankylosis. Splints must be occasionally removed and plasters and bandages taken off. Gentle manipulation of the joint must be carried out; or intelligent massage, hot fomentations, hot air baths, and baking had recourse to to facilitate absorption and resolution. In these later stages it is still believed that the iodide of potassium may do good.

COMPLICATIONS. *Hyperpyrexia.* The sudden onset of excessively high temperature, with extreme restlessness, headache, vomiting, delirium, and later coma, suggestive of meningitis, while occurring in the course of other febrile processes, is relatively common in rheumatism. It must be treated promptly and on the same principle as a sunstroke, that is, by a rapid withdrawal of heat. This is effectually done only by the use of cold baths or packs. The patient is put into a tub at 65° F., or, if the shock is too great, the water may be warmed to 80° F., and as the water warms from the patient's body heat, the temperature is kept down by adding ice to it. The patient should be kept in the bath until the temperature falls several degrees. If a fall to about 102° F. can be attained, the patient should be removed from the bath, as the temperature will often continue to fall. During the bath, ice or cold water should be applied to the head. The bath should be repeated as often as the temperature rises to between 104° and 105° F. If the patient becomes chilled, is cyanosed, the temperature falls well below normal, or collapse threatens, he should be removed from the bath, put in warm blankets, heat applied, and stimulants freely used. A cold pack, the wet sheet in which the patient is wrapped being continuously rubbed with pieces of ice until the desired drop is obtained. is sometimes quite as efficacious as the bath.

Cardiac Complications. The frequency of these complications, and their gravity, threatening not merely the patient's life in the present attack, but, worse yet, his future, dooming him to a life of invalidism and dependence, make them by far the most important features of the attack, and haunt the physician from the incipiency

of the disease. A visit should never be completed without a careful examination of the heart. Changes in rate, rhythm, quality of sounds, or the appearance of adventitious sounds, should immediately put the physician on his guard. It cannot be too emphatically insisted that the mildest attack, as judged by fever, pain, joint implications, and general discomfort, may still be accompanied by grievous heart implication.

Statistics vary, but from reliable sources it is gathered that pericarditis occurs in 15 per cent. of the cases, and endocarditis in over 50 per cent.; in children under ten years, in as high as 75 to 80 per cent. It must be remembered that a more proper term for what actually exists in the heart is pancarditis, for the whole structure is likely to be implicated. The treatment of these conditions is the same as when occurring under other circumstances, and is dealt with elsewhere. The only question to be discussed at this juncture is the use of salicylates. Some authors fear the depressing effects of the drug. Others maintain that the condition responds more favorably to the alkaline treatment. Others still consider that the appearance of the cardiac complications indicates no change in the treatment. Personally, I have always continued the salicylates; but if, in addition to evidences of inflammation, the heart shows that it is becoming incompetent, I then stop the salicylates or any drug that may confuse a judgment of the factors concerned, and rely on the ordinary measures pursued in heart disease.

Pulmonary Complications. Pneumonia and pleurisy occur in a considerable number of the cases, some authors giving the figures as high as 10 per cent. I, myself, have seen it frequently in the severe rheumatism, and always with the cardiac involvement. The treatment is such as would be instituted under other circumstances.

Other Complications. Sore throat, urticaria, sleeplessness indicate no special considerations, as occurring in this particular disease. Anemia is a striking feature of the disease, and indicates in convalescence the use of iron and iron-containing foods. Sweats of a severe type have long been associated in the minds of physicians with rheumatism, and may require especial consideration. They are very acid, and may cause considerable irritation. Sponging with a mild alkaline solution, as 1 per cent. sodium bicarbonate, gives relief. The skin should be kept dry with one of the numerous powders that contain talcum, or one made of equal parts of zinc oxide and starch. If the sweating is very severe, atropine may be used in doses of $\frac{1}{100}$ to $\frac{1}{60}$ grain.

Convalescence. The patient should be kept in bed for some time after the symptoms have subsided—one or two weeks. The diet should be increased to include green vegetables, later eggs, fish, and meat. It should be simple in its character and in the manner of its preparation. It should be sufficient, but not excessive, nor should the patient be teased to stuff by palatable dishes. A change of

environment often helps to establish convalescence, but the patient should not be hurried away too soon or exposed to discomforts in his new surroundings for the mere sake of the change.

Prophylaxis. The avoidance of this disease, so lamentable in its consequences, must rest upon our education of the public in hygiene, through the schools and other agencies. The gospel of fresh air must be preached, clean bodies, proper clothing, avoidance of neglect, such as remaining in wet and damp clothing. More than this, parents and teachers must be made to understand the meaning of chorea, sore throats, stiff necks, and "growing pains" in children, and the results of neglect.

DECOMPRESSION IN THE TREATMENT OF MENINGITIS.

LUMBAR PUNCTURE IN THE LIGHT OF RECENT ADVANCES.

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The diagnostic value of lumbar puncture is so well established that I need not dwell upon it. The therapeutic indications for opening the sacral cistern should be equally plain, yet the surprising fact is that even leading text-books on internal medicine are very indifferent as to its use in meningeal dieases. Thus, Koplik[1] and P. Tchernoff[2] advise lumbar puncture *only* for diagnosis. Dieulafoy[3] says it is of no use in the treatment. Holt[4] is at least fair in saying it does no harm, and it may help greatly. Local clinicians seem to dread lumbar puncture even as diagnostic, because once in a great while some one reports a death after the performance, although such a fatality could easily be avoided. Neisser and Pollack[5] say that internists are astonishingly slow to puncture the spinal arachnoid space, although they have promiscuously punctured every other organ or viscus in the body. Be all this as it may, we must agree that the attitude of some authors has resulted in an undeserved neglect of an exceedingly useful therapeutic agent, which, if employed properly, would save many lives and relieve a great deal of unnecessary suffering on the part of the patients.

A critical study of the genesis of the meningitic symptoms conduces to a better understanding of their mechanism, and, consequently to a more logical treatment. The most prominent features

[1] Jour. Amer. Med. Assoc., April 6, 1907.
[2] Archiv f. Kinderheilkunde, February 1, 1906.
[3] Pathologie Interne, 1904, iii, 686.
[4] Diseases of Infancy and Childhood, 1906, p. 766.
[5] Chirurg. Operations-Lehre, 1906, p. 299.

of meningitis—headache, vomiting, and stasis papillæ—are distinct evidences of increased intracranial pressure, whatever morbid lesions they may be based upon. The relief of that excessive pressure becomes the prime indication for immediate lumbar puncture. As early as 1905 P. Marion[6] held this procedure "an excellent agent of decompression, often curative, always palliative." Kocher[7] insists upon the causal therapy of excessive intracranial pressure, but it is more humane first to relieve the pressure, and then apply etiological treatment, such as antisera, hemostasis, etc. In meningitis the mechanical effects outweigh the toxic lesions. The damage from the former becomes soon irreparable, while the toxic lesions disappear sooner or later, often completely, even after several weeks of duration. Harvey Cushing[8] lays great stress upon the early decompression in excessive intracranial pressure from whatsoever cause. A review of the pathologic-anatomical lesions in meningitis will convince any trained observer of the preventability of these irreparable morbid changes. Energetic prophylactic decompression would reduce to a minimum such disastrous results as optic neuritis, deafness, oculomotor disturbances, and some psychopathies, all of which are due to the mechanical effects of the excessive intracranial pressure. Stieren[9] favors decompression as soon as a diagnosis of excessive intracranial pressure is made, and only then employs medical treatment. The weight of evidence favors the mechanical theory of stasis papillæ, such as advocated by Horsley, Cushing,[10] Spiller,[11] Allen, and others.

Personally I agree with those observers who accept the physical mechanical genesis not only of optic neuritis, but of the totality of the meningeal symptoms. They are avoidable, provided we use decompression early enough. The diagnosis of meningitis depends upon the timely recognition of pressure symptoms. This implies a careful analysis of the findings in the case. Meningitis must be suspected earlier than hitherto. I have elsewhere insisted upon the value of repeated careful blood examinations in this class of cases.[12] Total and differential leukocyte counts will furnish us with very valuable information in the early diagnosis of intracranial hyperpressure. Spiller thinks that when we learn to distinguish between the increased intracranial pressure of inflammatory origin and that of non-inflammatory nature, trephining (decompression) will be more advantageous. The possibility of recovery from meningitis has never been denied, but the consensus of text-book writers and of general experience have discredited it so much that we should not

[6] Chir. du Système Nerveux, Paris, 1905.
[7] Encyclopedie der Gesammten Chir., 1901.
[8] Johns Hopkins Hosp. Bull., March 1, 1905.
[9] Surgical Interference in Choked Disk, Ophthalmic Record, March, 1908, p. 139.
[10] Cerebral Surgery, etc., Jour. Amer. Med. Assoc., January 16, 1909, p. 184.
[11] Internal Hydrocephalus, Jour. Amer. Med. Assoc., April 13, 1907.
[12] The Leukocytes in Meningitis, Chicago Med. Recorder, November, 1908.

wonder when Kaufman,[13] in his last edition, says of tuberculous meningitis "it is nearly always fatal." Up to now, the actual recoveries from tuberculous meningitis have been confined to a few text-book reports, although several experienced pathologists told me personally of postmortem findings justifying the retrospective diagnosis of preceding healed meningitis. In those cases, of tuberculous or other nature, when the meningitis is neither a terminal process of a generalized infectious disease, nor an accessory part of an actual serious malady, the outlook should be very good, provided, of course, decompression be early resorted to. Furthermore, I believe that in the near future we shall be able to report a great many cases of meningitis, tuberculous as well as others, with prompt and full recovery. I am convinced that the cases here reported will not remain in the literature as isolated facts, and that the field opened by Jaboulay, Horsley, Cushing and Frazier,[14] Spiller,[15] and Bordley will yield a goodly crop of results.

I feel that meningitis in general, and tuberculous meningitis in particular, has an enormous mortality simply because we allow it to have its way until the lesions produced during our extreme passivity have become irreparable. Theoretically, as I have held for years, a simple meningitis is curable by the timely removal of the excessive intracranial pressure. This has been realized in practice, as shown by the following cases, of which three occurred in my own practice and one case in that of Dr. C. A. Erickson.

Case I.—Record 1879. September 22, 1908. The patient was seen also by Dr. I. A. Abt and Dr. M. Kahn.[16] The case was treated as one of tonsillitis during the first thirty-six hours. The diagnosis of meningitis was confirmed by lumbar puncture on the fifth day of the disease; 62 c.c. of very clear fluid, escaped under marked pressure. Microscopically, it was negative. Culture and animal experiments were negative. Examination of the blood: 10,200 white corpuscles. The differential count was: polynuclears, 61.4 per cent; small mononuclears, 27.6 per cent.; large mononuclears, 8.5 per cent.; eosinophiles, 0.5. The prognosis was bad before decompression, but the patient began to improve immediately after the lumbar puncture. No other therapy was used.

Resume. The case is one of serous meningitis, cured by lumbar puncture alone. The patient is in excellent health now.

Case II.—Record 1894. January 8, 1909. Eda R., aged six years. Was seen with Drs. M. Bacon and C. M. Piper. Only child, thin and tall. Healthy enough as a baby. Intermittent bronchitis in childhood. Measles one year ago. In good health then until three days ago, when two hours after a fall while roller skating

[13] Spez. pathol. Anatomie, Berlin, 1907.
[14] Cerebral Decompression, Jour. Amer. Med. Assoc., September 1, 1906.
[15] Palliative Treatment for Brain Tumors, Jour. Amer. Med. Assoc., January 29, 1909, p. 272.
[16] Reported in Chicago Med. Recorder, November 1, 1908.

began to complain of headache and nausea which kept getting worse. Vomiting at random. Patient feverish and restless, at first, but rather drowsy in last twenty-four hours.

The child was found in dorsal decubitus, with knees flexed. The head was retracted and opisthotonos quite marked. Rigidity of the spine and the Kernig symptom were pronounced. There was slight ptosis of both upper lids, yet no squint. Pupils normal. Child partially conscious, but rather dull and drowsy. Temperature, 102.8°; pulse, 120; respirations, 30. Moderate tonsillitis. The examination of the skin, joints, lungs, heart, and abdomen was negative. The leukocytes were 40,000 whites (two counts). Differential: polynuclears, 86.3 per cent.; small mononuclears, 9.9 per cent.; large mononuclears, 3.8 per cent.; eosinophiles absent. Lumbar puncture: 45 c.c. of very clear fluid, sterile on microscopic examination, but showing moderated polynucleosis (70 per cent.).

The child improved very slowly during the next four days. On the second day after the lumbar puncture, distinct signs of pneumonia over the right upper lobe; on the fourth day a double otitis media purulenta appeared. Nevertheless, under good nursing, etc., the patient improved so that a week after the puncture, that is, eleven days after the onset, she was able to sit up in her bed for her meals, and had normal temperature.

Resume. A case of undetermined meningitis, but probably of influenzal nature (leukocytic formula, pneumonia, and otitis media). Improvement occurred after lumbar puncture and progressed to complete recovery. The patient is in good health now.

CASE III.—Record 2007. Seen with Dr. M. Kahn, January 14, 1909. Julius G., aged four years, well built, well nourished, always well until two days ago, when he took sick suddenly with convulsions, fever, vomiting, and constipation. These symptoms increased in severity until the patient presented the following: half sitting in bed, conscious though a little dull, face flushed, cephalalgia, and random emesis. Slight left ptosis. Head well retracted, neck quite rigid and tender, vertebral column stiff, Kernig symptom manifest. No automatic movements. Temperature, 103°; pulse, 100; respirations, 30. Lungs, joints, throat, and abdomen negative. Lumbar puncture: 70 c.c. of a rather opalescent fluid, under marked pressure, showing 66 per cent. of polynuclears, and 33 per cent. of mononuclears. A cocobacillus with the microscopic features of the Pfeiffer influenza bacillus was found. Injection of 12 c.c. of the fluid into a guinea-pig remained negative. Leukocytes, 22,500 total whites. Differential count: polynuclears, 69 per cent.; small mononuclears, 26.5 per cent.; large mononuclears, 4.5 per cent.; eosinophiles absent. There was mixed polynuclear and lymphocytic leukocytosis.

Resume. Acute meningitis, probably influenzal, with very rapid recovery after decompression. The patient is in good health now.

CASE IV.—Report kindly furnished by Dr. C. A. Erickson. Boy, aged seventeen years, with negative antecedents except for suppurating cervical glands in early childhood, and a Neisser infection two years ago. Fell two stories several years ago, but did not injure himself. Initiated into a fraternal society just before the onset of the disease.

About seven weeks ago, with occipital headaches, there was occasional vomiting, loss of appetite, constipation, lack of ambition, loss of weight. Symptoms aggravated progressively, and patient became mentally dull, somnolent, and irritable. He was first seen on May 19, 1909. Temperature was normal; pulse, 46; respirations normal; urine negative. Leukocytes, 14,800. May 20, 1909, he was seen in consultation by Dr. A. R. Edwards. The patient was in opisthotonos, with neck rigid and head retracted. Kernig symptom, diplopia, somnolence, and severe headache were present. The pulse was 50, the temperature normal.

A diagnosis of tuberculous cerebrospinal meningitis was made. Lumbar puncture: 100 c.c. of slightly cloudy fluid, under marked tension; cultures sterile; sediment chiefly lymphocytes. Three days afterward the headache, the vomiting, and the somnolence had entirely disappeared.

May 21, 1909. Left arm, Pirquet showed a markedly positive reaction. Leukocytes, 14,400; temperature, normal; pulse, 60. Patient improved rapidly, but on June 6, 1909, a second lumbar puncture became necessary on account of headaches and vomiting for two to three days previously; 60 c.c. limpid fluid removed. Since then the patient has improved very greatly, and is now apparently in perfect health.

Resume. A case of tuberculous meningitis, with recoverv. Lumbar puncture, as the only therapeutic measure used in this case, must be considered curative. The removal of intracranial hyperpressure, that is, decompression, was accomplished promptly and thoroughly by means of two consecutive lumbar punctures.

SUMMARY. 1. The semeiology of meningitic symptoms is identical with that of pressure phenomena.

2. The infectious toxic or toxic infectious factor in meningitis has been overrated hitherto, and the mechanical element of this clinical picture has been neglected.

3. The early diagnosis of meningitis depends mainly upon the recognition of actual or suspected intracranial hyperpressure, the removal of which becomes at once the foremost therapeutic indication.

4. Decompression by means of lumbar puncture is feasible in the vast majority of cases, because the aqueduct of Sylvius is seldom totally occluded.

5. The fact that Quincke originated lumbar puncture for the removal of intracranial hyperpressure gains additional value in the light of the recent studies of Harvey Cushing, Spiller, Frazier, Horsley, Bordley, Theodore Kocher, and others.

6. There are several reasons for the enormous mortality of tuberculous meningitis: first, the injury to the brain, due mainly to pressure, causing a degenerative encephalitis; second, the co-existence of advanced tuberculosis elsewhere in the body, usually in the lungs; and third, the occurrence of miliary meningeal tuberculosis, as a terminal infection in such diseases as nephritis, cirrhosis of the liver, etc.

7. Tuberculosis of the cerebrospinal meninges owes its danger to the mechanical effects produced by the excessive pressure upon the medullary centres or the gray matter, not to its infectious character, for, as we well know, tuberculosis elsewhere has a remarkable tendency to self-cure.

ESSENTIAL PENTOSURIA.[1]

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The old dictum that life is the chemistry of carbon receives additional illustration in the anomalous condition known as pentosuria—the presence in the urine of the pentatomic form of sugar. It constitutes as yet little more than a clinical curiosity, but suggests many important questions, whose answers, when found, will doubtless be illuminating as to certain dark corners of the field of metabolism.

Pentose is a species name rather than an individual designation. It is applied to a group of some eleven monosaccharids, having the general formula $C_5H_{10}O_5$, and thus differing, by one carbon atom and the elements of a molecule of water, from dextrose, levulose, galactose, etc., which, containing six carbon atoms in the molecule, are termed hexoses. But this apparently slight chemical difference is of considerable physiological and pathological importance. The sugar which appears in the urine in diabetes mellitus is dextrose; and, as we all know, its presence usually indicates a profound and often dangerous disorder of metabolism, associated with distressing symptoms and having a somewhat uncertain dependence upon more or less definite structural lesions. While hexosuria is thus potentially and often

[1] Read at a meeting of the College of Physicians of Philadelphia, May 5, 1909.

actually grave, pentosuria, on the other hand, is essentially mild. It is unaccompanied with the polyuria, polydipsia, and bulimia of saccharine diabetes; it is not characterized by emaciation or by obesity; and, so far as yet appears, is unattended with special liability to pyogenic and other infections or with the risk of acid intoxication. Of its possible association with definite tissue changes or circulatory disturbances nothing is known.

Urinary dextrose is optically active; as the name implies, it rotates the polarized ray to the right. Being a reducing aldose, it is commonly recognized by its power to precipitate metals or their oxides from solutions of metallic salts, especially those of copper and bismuth when heated with an alkali. It is fermentable with yeast. These properties are manifested by the hexoses in general, as well as by the disaccharids—for example, sucrose and maltose—which contain twelve carbon atoms and may, by the hydrolyzing action of dilute mineral acids, be made to take up the elements of an additional molecule of water and separate into two hexose molecule groups. The pentoses are likewise reducing aldoses. They behave much like dextrose with the bismuth test of Boettger, but the reduction of metallic bismuth is usually incomplete and the precipitate is brown or gray, rather than an absolute black. With Fehling's solution, they give a peculiar reaction, producing somewhat suddenly, after some minutes' boiling, a heavy greenish or yellowish or orange-colored precipitate in place of the red or salmon-colored oxide with whose gradual development we are familiar. While decomposable by the action of certain bacteria, and especially the intestinal flora, they do not, however, ferment with yeast, and their bacterial decomposition is not attended with the evolution of gas. Consequently, in the examination of a specimen of urine which reduces bismuth imperfectly and gives an anomalous or incomplete copper reduction, the failure to ferment, more especially if polariscopic examination shows the reducing substance to be optically inactive, should direct attention to the possibility of the presence of a pentose. Diabetes mellitus is in such instances excluded; but other chemical tests must be made before the identity of the reducing, non-fermentable substance can satisfactorily be established. The most difficult discrimination is that between glycuronic acid and pentose. In the case which I report herewith I availed myself of the chemical skill and knowledge of Professor Charles H. La Wall to make this discrimination, and he has kindly consented to report the results of his tests and to explain their significance. While optical inactivity is almost conclusive, both against dextrorotatory glucose and levorotatory glycuronates, it must not be forgotten that many of the pentoses are optically active; and at least one of these has been known to appear in the urine. The crucial test is the recognition of the melting point of the crystals of pentosazone produced by

the action of phenylhydrazin. Spectroscopic examination, moreover, shows different positions of the absorption bands of the substances produced by the action of various reagents with glycuronic acid, dextrose, and the pentoses.

The pentose group of saccharids—or, more correctly, a group of anhydrides, called pentosans, which bear the same relation to the pentoses that starch, for example, bears to dextrose—is widely distributed, if not universally present, in the vegetable kingdom; being found in fruits, leaves, stems, and roots. The legumens and, among fruits, the pear, are especially rich in pentosans. The nucleinic acid of the embryos of wheat was found by Osborne and Harris to contain three molecules of pentose to each 4 atoms of phosphorus. Pentose has been demonstrated by Kossel and Neuman in the nucleinic acid of yeast, and Bendix, as well as Aronson, has found it in bacteria, including pathogenic forms, as tubercle and diphtheria bacilli. The most common forms of vegetable pentose are those termed l-arabinose and l-xylose. In the animal body, pentose was first discovered by Hammersten as a constituent of the nucleoproteid of the pancreas. The substance thus discovered has been identified as l-xylose. Since then various observers have demonstrated its presence in the liver, the thymus, the thyroid, the spleen, the kidney, the muscles, the brain, and the mammary gland, and it is, in general, supposed to be a persistent constituent of the nucleus; so that it is most abundant in those tissues that are rich in nuclei. Nevertheless, the whole amount contained in an ordinary adult human body has been calculated as not more than about 10 grams.

Pure pentose, when given to man or the carnivora by the mouth or injected into the blood, may be in small part assimilated; but it is usually, for the most part, rapidly excreted in unaltered form in the urine. Nevertheless, large quantities of pancreas or of vegetable foods containing pentosans may be ingested without the production of an alimentary pentosuria; probably on account of the slowness with which the saccharid is set free from its proteid combinations. The discordant results obtained by various observers in regard to the quantities of pentose recoverable from the feces and urine when pure xylose or pure arabinose has been administered by the mouth, are to be attributed in some measure to its decomposition, with the formation of lactic acid and alcohol, by the intestinal bacteria; and this process probably tends also to prevent alimentary pentosuria under ordinary conditions. While the pentosans and pentoses seem to play an important part in the nutrition of herbivora, no animal or vegetable enzyme that will hydrolyze pentosans has been demonstrated with certainty; and the physiological questions concerning their assimilation and utilization are as yet quite unsettled.

When alimentary pentosuria is induced by the feeding of pure

pentose, the form that appears in the urine is the dextrorotatory l-arabinose,[2] whereas that which appears in essential pentosuria is the optically inactive r-arabinose. The apparent exception reported by Luzzato is attributed by some critics to a transient alimentary pentosuria accompanying the essential form. Urinary pentose is supposed to be excreted in combination with urea, as an arabinoseureid. To this fact is to be attributed the slow reduction giving rise to the peculiar reaction with Fehling's solution; for the sugar must first be set free from its proteid combination by the action of the heat and alkali; and this decomposition occurs only after some minutes' boiling. In fact, in the first examination of the specimen from my own case I was unable to get any response to Fehling's test until I had added a decided excess of alkali.

Pentosuria was first clinically recognized in 1892 by Salkowski and Jastrowitz. The patient happened to be a person addicted to morphine, and his drug habit was supposed to have some causal connection with the condition. This idea, however, has been disproved. In 1895 Blumenthal reported two additional cases from Salkowski's laboratory. Since then a number of cases have been reported, most of them, however, from the First Medical Clinic in Berlin and Salkowski's laboratory. Neuberg identified the urinary pentose as r- or racemic arabinose, which is optically inactive, but may be decomposed into dextrorotatory and levorotatory constituents. Luzzato, however, found the pentosazone obtained from the urine of his patient to be slightly dextrorotatory, corresponding in this respect with the pentosazone of the l-arabinose of the vegetable kingdom. In my case a dextrorotation of scarcely 1° was found on one occasion only. The significance of this will be discussed later.

Three varieties of pentosuria have been recognized:[3] (1) *Alimentary pentosuria*, in which the phenomenon follows the ingestion of food rich in pentose-producing substances. (2) *Complicating pentosuria*, in which the urine contains both pentose and hexose—the cases being actually diabetes mellitus, and the small quantities of pentose transiently present having no known clinical significance.

[2] The letters *d*- and *l*-, as prefixed to the names of the various pentoses, are as likely to be confusing to other physicians who do not happen to be expert chemists, as they were to me until I learned the facts. One would naturally suppose that *d*-arabinose is dextrorotatory and that *l*-arabinose is levorotatory; but the exact contrary is the case. The letters do not indicate the optical activity of arabinose, xylose, etc., but that of the hexose molecules with which the pentoses are respectively chemically homologous.

[3] The substance obtained by Cammidge from the urine of patients having pancreatic disease is also supposed to be a pentose. In a recent case of my own showing a slight Cammidge reaction glucose was excreted for a few days; and then a reducing, non-fermentable substance, not yet identified. A similar series of phenomena occurred in the case of an obese woman of diabetic and carcinomatous heredity, and marked vasomotor ataxia of the menstrual variety; suggesting a possible origin in pancreatic circulatory disturbance. This case is reported in my paper on "Visceral Angioneuroses," in the Transactions of the Association of American Physicians, 1909.

Similar to these cases are the instances of experimental pentosuria found to accompany the diabetes mellitus of dogs deprived of the pancreas or poisoned with phloridzin. (3) *Essential pentosuria*, in which the excretion of pentose is persistent, independent of diet, and not associated with diabetes mellitus. It cannot be said, nevertheless, that in essential pentosuria there is no association with hexosuria. The relation, however, is the reverse of that obtaining in complicating pentosuria. It is now the dextrose that appears transiently and in minute quantities, and even this has been recorded in but a few cases, of which my own appears to be one.

According to T. C. Janeway,[4] who, in 1906, reported two cases of essential pentosuria in brothers, there had been previous to his report but seventeen indubitable cases placed upon record, of which one came from Italy and two from Norway, but none had been found in British, French, or American literature. So far as I know, the present is the fourth case observed, and the third case to be placed upon record, in the United States. Added to the seventeen cases collected by Janeway, with the two reported, and two others (unpublished) alluded to by this author, it would make twenty-two in all. I have not searched the literature since Janeway's report, and there may be a few more. At all events, the total number of cases recorded in the seventeen years elapsing since the first clinical recognition of the condition, has not reached forty. For this reason, isolated cases are still worthy of report.

My patient is a married man, a native of one of the middle Western States, aged fifty years. He has never had any venereal infection. He uses alcohol rarely and tobacco moderately. He is a leading member of the bar of his State, and is frequently required to appear in the supreme courts of other States and of the United States. It may, therefore, fairly be said that he has been engaged for many years in arduous, sometimes exhausting, mental labor; and, if we consider the strain of travel and of pleading, in physical labor as well. However, he has the vacation habit well established, and except for an occasional European trip, usually spends his summers in the woods or mountains, or on the Maine Coast, tramping, boating, fishing, hunting, or loafing, as the environment and his mood may suggest. When at home he rides and golfs as opportunity offers. He does not, therefore, strictly speaking, lead a sedentary life. He has recently—that is to say, for some four or five years past—been actively engaged in a movement for reform in the government of his city; and has had in connection therewith the burden of preparing important legal cases against a number of eminently respectable citizens. It is to be supposed, therefore, that he has been under a severe mental strain.

While he exhibits some of the signs of vasomotor ataxia, he is not what is commonly termed neuropathic; and there is not in his

[4] Amer. Jour. Med. Sci., 1906, cxxxii, 423.

family any history of neuropathic, arthritic, malignant, tuberculous, or diabetic affection. Cutaneous affections have been present.

He first came under my care about fifteen years ago with symptoms of subacid, gastro-enteric indigestion. Recovery took place under lavage, gastric faradization, and regulation of diet and exercise. The urine showed an excess of indican, as well as of uric acid, urates, and oxalates, but contained no albumin, sugar, or casts. An attack of furunculosis some years later made me study the urine carefully and persistently for glucose, but none was found. The patient has had from time to time brief periods of indigestion, sometimes a transitory constipation; but there has been no significant ailment of any kind. He has had periods of genuine and well-earned fatigue, but no neurasthenia. He has seen me at least once in every year, often more frequently; and I have probably examined his urine three or four times in each year, finding neither albumin nor sugar. He has also consulted, when necessary, a leading physician of his home city, one of my own pupils, whom I have associated with me in the case. It is unlikely, therefore, that any pathological occurrence would go long unnoticed.

In March, 1908, a life insurance examiner postponed his application, and he learned indirectly that it was on account of the urinalysis—albumin was said to be present. There was no suspicion, apparently, of sugar. The local physician examined the urine and found no albumin, but an anomalous reduction with Fehling's solution. He suggested that diabetes might be impending, but in the total absence of symptoms hesitated to make the diagnosis. A specimen of urine, taken from a twenty-four-hour collection amounting to 1500 c.c., was sent to Philadelphia. I found it to be clear, amber in color, 1023 specific gravity, acid in reaction, giving a brownish precipitate with bismuth subnitrate and potassium hydroxide, a greenish-yellow precipitate with Fehling's solution, and no gas upon attempted fermentation with yeast in Einhorn's saccharometer. There was no albumin; casts were not detected. A few leukocytes formed the only microscopic finding. Suspecting pentose, I enlisted Professor La Wall's cooperation, and, studying the specimen with him, found it to give all the pentose reactions, but in exception to be slightly dextrorotatory. A few days later the patient himself arrived. Careful physical examination showed nothing abnormal except a very slight enlargement of hepatic dulness, which had been present for some four or five years, and a very slightly increased arterial tension, not high enough, however, to indicate pathological change in the arteries. The blood was normal to microscopic and color study. The eye-ground had been examined by a local oculist, and was reported to be normal. The patient had gained some twenty pounds in weight during the last five years, but was not pathologically obese.

I have, in conjunction with Mr. La Wall and the local physician, kept the patient and the urine under observation, more or less closely, ever since; that is to say, for more than a year. Twice during that time he has complained of lassitude and indisposition to work—symptoms quickly disappearing after a few days at Atlantic City, or the brief administration of lecithin or glycerophosphates. Milk diet, flesh diet, diet with and without the ordinary carbohydrates, and diet with and without substances rich in pentosans have been instituted; for brief periods only, it is true, as the patient's activity does not lend itself to overmuch regulation or restriction. There has been practically no change in the urinary findings, except that although Mr. La Wall has not again found any dextrorotation, the local physician in February of this year did find, on one occasion, a few bubbles of gas; and on another, a reading of 0.25 per cent. by gaseous column, in Einhorn's saccharometer. I did not have either of the specimens, and cannot confirm the observation; but I know the observer to be accurate. This would seem to indicate some transient complicating excretion of a fermentable sugar [and, since the paper was read, a small quantity of hexose has again been found, as set forth in the footnote].

There is no instance on record of the transformation of pentosuria into diabetes, yet while knowledge remains so limited, care is necessary. I therefore thought it well to test dextrose assimilation more particularly. For this purpose I gave the patient, by the mouth, on each of two successive days, 100 grams of the glucose of pharmacy, in two portions; and with Mr. La Wall examined the total urine of the forty-eight hours. In this there was no trace of any excreted hexose, but pentose was found as before. No excess of indican has been found in the pentose-containing urine, although this was occasionally present before the pentosuria was discovered. The excretion of urea continues around 3 per cent. The chlorides in the late specimen were 0.94 per cent., or about 15.46 grams. The phosphates, estimated as P_2O_5, were 0.3 per cent., or 4.8 grams, a slight increase over the normal average. The total sulphates, being 0.31 per cent., or 5 grams, of which 0.3 per cent. represents preformed salts, show also a slight increase; while the rather low ratio of conjugate to fixed sulphates, 1 to 30, especially when taken in connection with the low indican content, would show a relative absence of intestinal decomposition. Bacterial study of the feces is therefore desirable, for a question is raised as to the possibility of absence or partial destruction of intestinal bacteria as a factor in the production of the pentosuria. Whether or not this study can be carried out, I do not know, but it calls for attention. The salol test does not indicate any failure of the secretion that splits this drug.

I have not specially experimented with the feeding of sucrose,

levulose, lactose, etc., or with any pure pentose; but hope to have the opportunity to make these and other observations from time to time, as the patient finds opportunity to visit Philadelphia, or we succeed in enlisting expert chemical assistance in his own city.[5]

The diagnosis of essential pentosuria is established by the persistence of the pentose excretion and by the absence of other symptoms.

The chief importance of this condition at present, apart from the interesting questions in physiological chemistry to which it gives rise, is its liability to be mistaken for diabetes mellitus, or, at all events, for glycosuria. Indeed, most of the cases hitherto recorded have been so mistaken until coming under the care of a physician familiar with the fact that pentose may appear in the urine, when the diagnosis has been corrected.

Pentosuria is apparently an intractable condition, but occasions very little inconvenience, and, so far as yet appears, is devoid of danger to life. About the worst thing that can happen to the patient is to have the condition mistaken for glycosuria and to be restricted in diet accordingly. This is very likely to cause loss of strength as well as of flesh. When, however, the true nature of the case is recognized and a diet properly adapted to the individual conditions instituted, the patient rapidly recovers from this loss and appears to be normal in every respect, except for the urinary findings. The only medicament which, from report, seems to influence the condition favorably, is arsenic. In the case of my own patient no medication has as yet been employed.

No light is thrown upon the metabolic fault concerned in the production of pentosuria by the habits, age, sex, vocation, nationality, or social and climatic environments of the patients as thus far recorded. Their ages vary from twenty to sixty-five years; they are of both sexes (although at first only males were reported), and their occupations, birthplaces, and environments have been as little similar as banking and farming; idling and practising law; wealth and poverty; Germany, Norway, Italy, and the Eastern and middle Western regions of the United States. Some of them have been morphine takers, some cocaine users, some neurasthenics. Two have been vegetarians. Quite a few cases have been

[5] Our patient, however, informs me that I have "overestimated his zeal for scientific research." He consented, nevertheless, to visit Berlin while in Europe this summer, and to see Dr. Jastrowits, who writes as follows:

"Both Professor Salkowski and I, can, from careful studies, entirely independent of one another, confirm your diagnosis of pentosuria. The first time that the patient brought his urine to me, I found, in addition to pentose, ½ per cent. of hexose, but although I had the urine of various periods brought to me later, as well as the entire twenty-four hours' quantity after diets rich in carbohydrates, I could not find any increase of hexose, but, on the contrary, only occasional traces of it; nor did the pentose seem to be notably increased after he had eaten many cherries (kirschen)."

observed in brothers, or in sisters, or in brother and sister; so that there seems to be some indication of a family tendency.

As the pentose continues to be excreted, even when the patients are put upon exclusive milk diet, and rarely seems to be increased notably, even by a diet of pancreas or pears, it is somewhat difficult to attribute the excretion of pentose to failure in assimilation of foodstuffs. The theory that pentosuria results from the breaking up of the pentose-proteid combinations of the body tissues has in its favor the discovery of arabinose in the blood of one or two patients; but against it, on the other hand, is the fact that the body pentose is l-xylose and the urinary pentose r-arabinose. Granting, however, that transformation of these isomers could be explained if we knew the intimate mechanism of the metabolic failure, there remains the still greater difficulty that the average daily urinary excretion in the cases thus far observed has been from 5 to 20 grams of pentose, whereas the entire body contains but about 10 grams. The problem, therefore, still awaits solution.

THE CHEMICAL EXAMINATION OF A SAMPLE OF URINE CONTAINING PENTOSE.[1]

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The urine, which had a specific gravity of 1023 and a yellow color, first attracted attention by the abnormal reaction produced when heated with Fehling's solution, which was not reduced to copper oxide, as is the case when the ordinary carbohydrates are present, but which produced a characteristic greenish turbidity and eventually a yellow precipitate. The fermentation test gave negative results, while a pronounced reduction was obtained by means of Boettger's test with bismuth subnitrate and solution of potassium hydroxide. A more extended examination, therefore, seemed desirable, and about a pint of the urine was furnished, with a request for an exhaustive investigation.

The first test applied was the alphanaphthol test, which is a group test for carbohydrates in general. It is applied by adding to a suspected sample of urine a few drops of a 10 per cent. alcoholic solution of alphanaphthol and then superimposing this liquid upon concentrated sulphuric acid. In the presence of any carbohydrate a violet zone is produced. This test resulted positively.

[1] Read at a meeting of the College of Physicians of Philadelphia, May 5, 1909.

The Fehling test was then applied, with the result as previously stated. The reaction showed a greenish turbidity, which was succeeded by a yellowish precipitate, wholly unlike the normal copper reduction.

The Boettger test, with bismuth subnitrate and solution of potassium hydroxide, showed a marked reduction to the dark-colored metallic bismuth.

The indigo carmine test for dextrose gave negative results.

A fermentation tube showed no evolution of CO_2 after twenty-four hours.

A polariscopic examination of the sample showed that it was optically inactive.

The phenylhydrazine test was then applied as follows: A clean, dry, six-inch test-tube was filled to the depth of one-half inch with phenylhydrazine hydrochloride, one-half inch of dried sodium acetate was added, and the tube filled to half its capacity with the urine and immersed in a bath of boiling water for two hours. Upon cooling the contents of the tube a voluminous deposit of yellow crystals took place, which, when examined microscopically, were found to be in stellate tufts of acicular crystals, resembling somewhat the groups produced by dextrose or levulose, but different in the character of the individual crystals, which seemed to be more slender in proportion to their length.

Several additional tubes of the crystals were prepared in a similar manner, and some of the crystals were collected and purified by recrystallization. During this purification it was noticed that the crystals were much more soluble in hot water than is the case with ordinary dextrosazone. The purified crystals were found to have a melting point of 157° C. This corresponds closely to the melting point of pentosazone; which substance was found by Salkowski and Jastrowitz to have a melting point of 166° to 168° C. when pure, but from 156° to 160° C. when obtained from urine. The melting point of dextrosazone (and levulosazone) is 204° to 205° C.

Several subsequent experiments upon fresh samples of material confirmed the melting point of the crystals, and the various specific tests for pentose were applied. Tollen's test, which is carried out by heating a solution of phloroglucin in hydrochloric acid and adding to the hot solution a small quantity of the urine, continuing the heat upon a water bath for some time, gave positive results in the shape of a cherry-red liquid which became cloudy upon cooling.

As glycuronic acid also responds to this test, further confirmation was obtained by applying the orcin-hydrochloric acid test, which is carried out similarly to the one previously described, using orcin instead of phloroglucin. In the presence of pentose a bluish-green color is developed, which is dissolved out by shaking with amyl alcohol. Positive results being obtained by this test,

thus negativing the presence of glycuronic acid, there seems to be no further doubt that there is exhibited in this sample of urine a well-developed case of pentosuria, as precisely the same results as above described were obtained in a specimen of urine from the same individual examined eleven months after the first report.

ADIPOSIS DOLOROSA WITH MYXŒDEMATOUS MANIFESTATIONS.

By Heinrich Stern, M.D.,
of New York.

Adiposis dolorosa is not a disease entity, but a condition characterized by a more or less definite symptom-complex. The two phenomena which are always encountered are irregular deposits of fat in the subcutaneous tissues, and pain in the fatty swellings. The other characteristics which are usually but not inevitably present are weakness, mental disturbances, and disorders of menstruation. There are other symptoms which may occasionally supervene, as sensory disturbances, headache, and diminished perspiration. It is an affection occurring in the vast majority of instances in women, generally setting in between the fortieth and fiftieth years of life, at a period when the menstrual functions are more or less deranged or the menopause has already become established. As but fifty cases of the condition have been reported in literature since Dercum first described the symptom complex in 1888, every additional instance of it should be recorded, especially if it presents certain features of myxœdema, as does the case narrated in the following:

Mrs. E. W. was referred to me by Dr. J. Gutman, of New York City, on April 21, 1908. The patient is a native of Roumania, belongs to the Hebrew race, is forty-two years old, married for eighteen years, and has never been pregnant. Her immediate family history is good; alcoholism, insanity, epilepsy, tuberculosis, or cancer had not occurred in a single member thereof. Her husband has never been affected with any venereal disease. The patient is bright, well educated, and apparently anxious to assist her medical adviser.

Menstruation started in the thirteenth year, but was never profuse. Since puberty the patient has not had an infectious disease necessitating staying in bed. About four years ago she slowly began to grow fat. At present she weighs 224 pounds. For the last year she noticed a progressive weakness, palpitation, and shortness of breath on even the slightest exertion, and, as she herself explains, "tiredness of soul and body." She has had non-

pitting œdema of the face, legs, and feet, and suffers with paroxysms of pain in the entire legs, especially in the calves and the posterior portions of the thighs. The pain becomes excruciating on standing, and even more so when walking. There are also pains in the region of the neck and chest, but they are of a more fleeting nature. For the past two years the perspiration is noticeably reduced, even during hot weather, and the hair has been falling out in a marked degree.

Examination. The patient has an apathetic, bloated physiognomy, is well developed, and has large diffused deposits of fat over the abdomen, shoulders, and back, but desultory accumulations of fat are particularly noticeable just above the ankles, on the posterior and inner sides of the calves, the inner sides of the knees, and the external sides of the thighs and over the lower portion of the buttocks. While there is but little pain elicited on pressure upon the abdominal, cervical, and dorsal fat layers, the sensitiveness of the fat deposits in the legs is very pronounced when pressure is applied. The lower the location of the fat deposit the greater proves the pressure pain. The most acute pain is induced in the fat pad around both ankles; the pain induced in the fat deposits on the inner side of the knees and over the calves is less sharp, but much more intense than the induced sensitiveness in the fat masses of the thighs and buttocks. There are no lumpy fat deposits in the upper extremities. The circumscribed fat masses in the lower extremities are quite firm and do not pit when pressed upon. The integument directly over and surrounding the circumscribed fat deposits is soft and pliable, having retained more or less its normal character. In the face, however, the skin is rather firm and inelastic, and exhibits areas of distinct roughness. There is a slight enteroptosis, and the flabby panniculus hides the external genitals. The respiratory organs show nothing abnormal; there exists without a doubt a fatty infiltration of the heart. No cardiac lesion besides this is discernible, but the second aortic sound is distinctly accentuated. The blood pressure over the radial artery is 90 mm. Hg. by Potain's instrument. The thyroid gland is not palpable. The cervical and axillary glands are not enlarged, but just above the clavicles there are small superficial nodules which seem to be due to the shrivelling of the skin and the subjacent structures. The liver is normal in size and presents nothing unusual around its lower border. The spleen is not palpable, and its area of dulness appears to be of normal extent. The stomach is somewhat ptotic, but not enlarged. There is a marked pressure pain in the region of the descending colon and the sigmoid flexure; this is undoubtedly caused by hardened feces accumulated therein. The inguinal glands are not enlarged. The temperature, taken by mouth and rectum, is normal. Muscular power is much diminished, and the patient cannot hold the arms extended without much effort. There is greater muscular strength

in the lower extremities, but even a slight exertion causes more or less pain. The patellar reflexes and the tendo Achillis reflex are diminished. The deep reflexes of the upper extremities are sluggish. Babinski's reflex cannot be elicited. There is no tenderness over the nerve trunks. Coördination, sense of orientation, and stereognostic sense seem unimpaired. The ocular phenomena are negative. The percentage of hemoglobin is 70. There are no abnormal urinary features, neither chemical nor microscopic.

A *diagnosis* of adiposis dolorosa with symptoms of myxœdema was entertained.

The *treatment* advised consisted of an anti-obesity diet, thyroid medication, and physical therapeutics, especially vibratory massage and exercise.

May 10, 1908. The patient has executed the prescribed treatment under the supervision of her family physician. Her present weight is 210¼ pounds. She feels weak, but is not discouraged. The pains in the legs continue; they are so severe in the morning that she cannot make any steps, but is compelled to crawl on her knees if she has to move about. Later in the day the pains subside to some extent, and then she is able to take some exercise. The findings of the physical examination do not materially differ from those obtained on the previous occasion. The twenty-four hours' urine amounts to 1200 c.c.; there are no pathological elements contained in it. In addition to the former treatment special exercises for the feet and a supporter for the pendulous abdomen are recommended.

July 15, 1908. The patient has religiously executed the treatment with the aid of her physician. She weighs now 188½ pounds. She complains of "general weakness from head to feet." She looks exceedingly anemic. The thyroid had to be temporarily withdrawn on account of increased cardiac palpitation and some arrhythmia. The physical examination demonstrates a stronger cardiac impulse. The radial blood pressure amounts to 120 mg. Hg. taken with Potain's instrument. The urine remains unchanged. Glucose in clinical amounts cannot be ascertained. The treatment is continued excepting the thyroid medication, which is to be resumed in a week or two, but in smaller daily doses.

January 4, 1909. The patient presented herself today to show me the beneficial effects of the treatment. Excepting the pallor, which, she says, has always caused her much annoyance since her early youth, she looks very well. She feels strong, and is able to walk from five to eight miles a day; she experiences no shortness of breath on ordinary exercise, but perspires mildly when she walks briskly. The fat bunches have disappeared almost entirely; the neuralgic pains ceased about four months ago; there is no tenderness on pressure on the location of the former fat masses. The skin in the supraclavicular regions and in the face has been quite

tender. She evinces not the slightest mental depression and apathy, but, on the contrary, displays a healthy optimism. Her present weight is 161 pounds.

COMMENTS. The foregoing case is of especial interest for two reasons—the concurrence of adiposis dolorosa with well-marked myxœdematous manifestations, and the synchronous abatement of the symptoms of both affections after thyroid medication and a general anti-obesity treatment.

Symptoms of myxœdema are known to supervene in a certain proportion of the cases of adiposis dolorosa. Dercum's first publication on this subject was entitled "a subcutaneous connective-tissue dystrophy resembling myxœdema," and Henry reported some time later a case under the caption of "myxœdematoid dystrophy." Thus, the possible concurrence of both conditions, or at least a certain resemblance of adiposis dolorosa with myxœdema, was recognized by the early writers on the syndrome.

The instance of adiposis dolorosa under consideration exhibited the following myxœdematous manifestations: Apathetic, bloated physiognomy; history of non-pitting œdema of face, legs, and feet; firm, inelastic, and rough skin in the face (seat of former œdemas); falling out of the hair; non-palpable thyroid, and dermal tumefactions in the supraclavicular areas. This symptom complex alone would prompt the diagnosis of myxœdema, but it was overshadowed, at least for the time being, by the acuteness of that of adiposis dolorosa. The association of the two syndromes is by no means accidental, although it appears that in none of the cases of adiposis dolorosa on record were the myxœdematous features as plentiful and well pronounced as in the case before us.

In view of the frequency of myxœdematous symptoms in adiposis dolorosa, I think we are justified in accepting a kindred cause of both syndromes. That thyroid insufficiency stands at the foundation of myxœdema there can be little doubt; again, some thyroid alteration was found in four out of five cases of adiposis dolorosa which came to autopsy. While the seat of the externally visible pathognomonic symptoms of myxœdema is in the subcutaneous tissues, that of adiposis dolorosa is situated in the fatty structures.

Moreover, the improvement of my case following the administration of thyroid extract seems to evince with certainty that perverse thyroid function was, so say the least, an antecedent. The yielding of both symptom complexes to the same medication again points to their interrelation or their springing from a kindred cause. Thyroid therapy cannot, therefore, be utilized as a test of differentiation between myxœdema and adiposis dolorosa, as some authors maintain, because both syndromes may vanish under its influence, and, as in the present instance, even at the same time. In so far as the pains disappeared in the ratio of shrinkage of the fat bunches, we are justified in concluding that the irritation of the nerve terminals

was either due to mechanical insults on the part of the overgrowth of fat tissue, or to certain fatty acids or products of katabolism exciting the nerve trunks in the vicinity of the fat deposits and stimulating the fat-tissue to further proliferation. In view of the fact that myxœdema occurs without pains in the swellings, it appears that thyroid insufficiency cannot be held directly responsible for the aches and paroxysms in adiposis dolorosa.

HEMOPHILIA WITH THE REPORT OF A CASE OF TYPHOID FEVER IN A HEMOPHILIC SUBJECT.

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By the term hemophilia we mean a peculiar hereditary anomaly of constitution characterized by traumatic hemorrhages of great stubbornness and also by a conspicuous tendency to spontaneous and repeatedly recurring hemorrhages, subcutaneous, subfascial, intra-articular, intraperitoneal, intrapleural, intracranial, or from the mucous surfaces. The condition, of course, must not be confounded with other pathological states, such as scurvy and purpura, in which there is a marked tendency to hemorrhage; the former is a definite disturbance of nutrition, the latter an acquired condition dependent upon a variety of specific organisms or their toxins. Nor must we confound it with the so-called hemorrhagic diathesis associated at times with certain of the specific fevers, nor with multiple hereditary telangiectasis first described by Osler.[1]

According to Wilson,[2] priority is due Albucasis, an Arab, who died in Cordova A.D. 1107, and in whose writings a well authenticated instance of hemophilia is mentioned. Alexander Benedictus, in 1539, Hochsetter, in 1674, Legg, in the same year, Fordyce, in 1784, and Rave, in 1798, were among the earlier observers. The first American physician to mention the disease was Otto,[3] in 1803, and it was he who applied the term "bleeders" to patients afflicted in this way. He gave the history of a family in which the disease could be traced back 80 years. In 1813 Hay gave details of the Appleton-Swain family, which, it seems, was another branch of the family reported by Otto. In 1817 Buel[4] reported cases in the Collins family, and in 1828 Coates[5] recorded others in a Pennsylvania family. The German school here took up the study, and articles appeared by Nassi, Wachsmuth, Virchow, and

[1] Johns Hopkins Hosp. Bull., November, 1901.
[2] Practitioner, Lond., 1905, lxxv, 829.
[3] New York Med. Repository, 1803.
[4] Trans. Med. and Phys. Soc., New York, 1817.
[5] North Amer. Med. Jour., 1826.

others. Since that time a vast amount of literature has been accumulating, so that at present the mass at our disposal is too great to be given in detail in any brief paper.

Etiology. That the condition is hereditary is agreed by all observers, and Grandidier, in his monograph, calls it "the most hereditary of all hereditary diseases." The transmission may be direct from parent to child, but much more frequently follows a peculiar law, peculiar in that it reveals a remarkable difference in the frequency of incidence in the two sexes, females showing the greater tendency to transmit the disease, while acquiring it themselves but seldom, whereas just the reverse is true in the male sex. For instance, a mother of a family, although she herself has never manifested any hemophilic tendency, despite the fact that she is the daughter of a hemophilic parent, will transmit the disease to the majority of her male offspring, the ratio being about 11 to 1. Statistics show that for about every 13 males so afflicted there is only one female. Nevertheless, the view formerly held that women exclusively transmit the disease has been shown in recent years to be erroneous, and there are to be found in the literature instances in which fathers, themselves bleeders, and also fathers the sons of bleeders, though themselves not bleeders, have occasionally transmitted the tendency. Hence it is now agreed that men descended from bleeder families, whether bleeders themselves or not, occasionally beget hemophilic children, and that women descended from bleeder families, whether bleeders themselves or not, almost invariably give birth to hemophilic children. Lossen,[6] Gocht,[7] and Sahli,[8] in their articles on hemophilia, give very striking and interesting genealogical tables. That the tendency can be transmitted through several generations is well shown by the family tree first described by Grandidier and Vieli, and later by Hosli, in which the transmission was followed through seven generations. In several instances in this family the disease would skip two generations and reappear in the third.

Although heredity is responsible for the majority of the cases of hemophilia, a congenital form also appears to exist. By this is meant that children of parents not themselves bleeders, and who can give no family history of hemophilia, are occasionally hemophilic. These children will transmit the disease to succeeding generations.

So far as race is concerned, Germany furnishes the largest number, England is next, then France, then North America. Russia, Switzerland, Norway, Sweden, Holland, Belgium, Denmark, and East India all furnish one or more families. In the lower animals cases of hemophilia have also been reported. E. A. Weston[9]

[6] Deut. Ztschr. f. Chir., 1905, lxxvi, 1.
[7] Arch. f. klin. Chir., Band lix.
[8] Ztschr. f. klin. Med., 1905, p. 264.
[9] Vet. Records, Lond., 1904–05, xvii, 100.

reports a case of equine hemophilia, and Villemin[10] reports a case in a dog.

Although the actual cause of hemophilia is still unknown, numerous hypotheses have been advanced. Some authors lay stress on marriage between blood relations and maternal impressions as causative influences. Neither view, however, appears to be well founded. Among the many other theories advanced the following may be mentioned: Cohnheim assumed some change in the erythrocytes as explanatory of the condition, but this view has received no confirmation from other observers, and Litten claims to have absolutely disproved its possibility. Immermann[11] held that disproportion between the blood volume and the capacity of the vascular apparatus, resulting in an unusual pressure in the latter, produced the hemorrhages, but against this view is the fact that repeated blood pressure findings in the majority of instances that failed to reveal a tension greater than normal. Oertel,[12] however, expresses himself as in favor of Immermann's theory, and speaks of a hydremic plethora of high degree. Cohen,[13] working along the same lines, but unfortunately with only one case from which to draw his conclusions, suggested a treatment which has for its main object the reduction of the so-called hydremic plethora by means of energetic cataphoresis and diuresis. Von Recklinghausen's[14] hypothesis, that hemophilia is a neuropathic diathesis and secondary to vasomotor disturbance, is based mainly upon the observation that neurotic symptoms are frequently seen in bleeders, but, as Litten points out, whether these neurotic manifestations are *post hoc* or *propter hoc* is by no means clear. W. Koch, of Dorpat, believes hemophilia to be merely another manifestation of scurvy, purpura, or similar conditions, and claims that it is a toxic infectious disease, but this theory can hardly be well founded in face of the fact that no specific pathogenic organism has ever been isolated or proved to exist in hemophilic patients. Moreover, it seems most improbable that such agents existing in a parent should fail to appear in the next generation and yet reappear in the following; nor would it be possible to explain in this way the marked discrimination on the part of the organism between the sexes. In the cases in which Kolb, Babès, Gærtner, Tizzoni, and Giovanni demonstrated bacteria, and referred to as instances of hemophilia of the new born, the hemorrhages were probably analogous to those so often seen in septic and other infections, and should be classed as toxic instead of hemophilic hemorrhages. In a case in which

[10] Jour. de méd. vét. et zoötech., Lyon, 1904–05, viii, 590.
[11] Ziemssen's Handb. Pathol. u. Ther., 1879, xiii, 2.
[12] Therapy of Diseases of the Circulation.
[13] Ztschr. f. klin. Med., Festschrift, 1890.
[14] Handb. der allg. Path. des Kreislaufes der Ernahrung.

he reports the clinical and pathological findings, Virchow[15] thought that the hemorrhages were due to a deficiency in vascular development. Litten holds that if the disturbance be a vascular one, and takes place during fœtal development, it may do so in one of two ways—"either in a greater or less development of the connective-tissue germ, or because individual portions of this structure suffer particularly. Of special importance is the fact that it is the maternal element which transmits the disease without being itself necessarily involved, this property being an inherent function of the maternal body and much more marked in the feminine descent than in the masculine. This faculty can exist only in the parablastic tissue and especially in the vascular system which arises from it. Consequently it is very likely that the parablast of all the tissues of the organism is most influenced by the mother, being less subject to paternal impressions than any of the other constituents."

Pathological Anatomy. It is noteworthy that up to the present time experienced pathologists have not been able to agree upon any pathological findings as characteristic of hemophilia. At autopsy on patients dead from the hemorrhages marked anemia and a waxy appearance of the skin are usually noted. The internal organs contain very little blood and the fluid in the vessels is watery. W. Koch states that some observers have invariably noted an enlargement of the spleen—an observation by no means always verified by others—and believes this enlargement to be significant of the infectious nature of hemophilia. The blood-vessels of the skin are extremely superficial, the larger vessels, particularly the aorta and its main branches, are unusually narrow, the walls thin and elastic. Although this is true generally of the whole arterial system, the capillary vessels show no change. The intima is thin and transparent, the endothelial cells are enlarged, the nuclei swollen, and granular deposits are noted in the protoplasm. In some cases, but by no means in all, fatty degeneration of the intima, together with slight sclerosis, has been demonstrated. The arteries and veins show no large ruptures, the bleeding having evidently occurred from the capillaries. Virchow called particular attention to the persistence of the thymus gland in his case.

König,[16] in 1892, was the first observer to give a graphic description of the pathological findings in the joints. He divides such joints into three classes. To the first belong the cases in which there has been but one hemorrhage and the blood has been rapidly absorbed, leaving no trace except some discoloration of the capsule and synovial membrane. In the second class he places those cases in which repeated hemorrhages have induced thickening and discoloration of the capsule, the cartilage having lost

[15] Deutsch. Klinik., 1859, No. 23. [16] Volkmann's Samml. Klin. Vorträge, 1892.

its lustre and showing areas of softening. Blood coagula showing connective-tissue changes are found in layers upon the synovial membrane and cartilaginous surfaces, from which grow villi more or less luxuriantly. In the third class he puts those cases in which adhesions have formed between the villous growths; the synovial membrane is greatly thickened, the fluid has been absorbed, and there has resulted ankylosis with the limb in a flexed position.

SYMPTOMS. The symptom which first attracts the physician's attention in the majority of instances is an abnormal hemorrhage after some very slight injury, accidental or operative. Among the latter may be mentioned circumcision, the extraction of a tooth, perforation of the lobe of the ear, adenoid or tonsilar operations, or, in fact, any of the numerous minor surgical procedures. Among the spontaneous hemorrhages most frequently met with are epistaxis, bleeding from the gums, intestinal, pulmonary, gastric, renal, cutaneous, uterine hemorrhages, and bleeding into the joints. The hemorrhages are profuse, at times uncontrollable, and terminate in syncope or in death. Hematomas are found occurring upon any exposed part. Prolonged pressure in the sitting or lying posture has been known to produce large hematomas, or these may follow the slightest external violence, such as anyone is apt to incur while pursuing the usual avocations of life. These tumors usually resemble abscesses, and are extremely painful.

About the joint symptoms much has been written and numerous cases have been reported. According to König, in the first stage the condition is apt to be mistaken for acute articular rheumatism or synovitis. In the second stage the appearance is that of a tuberculous joint. In the third stage atrophy, ankylosis, flexion, and possibly subluxation may occur.

Senator,[17] in 1891, reported a case of bleeding from the kidney, and was the first to draw attention to hemophilia as an etiological factor in hematuria. Klemperer[18] and others[19] have reported similar cases. Unquestionably in many of the cases reported the macroscopic and microscopic examinations of the kidneys were not sufficiently thorough to warrant the exclusion of other more common causes. Nevertheless, it is a well-recognized fact that hematuria may be the sole manifestation of hemophilia.

The reports upon the clinical examination of the blood in hemophilia vary slightly as to the differential leukocyte count, but the deviation from normal is scarcely noteworthy. For instance, after examining the blood in three cases, Sahli found that there was a slight relative as well as an actual decrease in the polymorphonuclear leukocytes with a relative increase in the lymphocytes, the total leukocyte count being only slightly decreased or even normal. In two cases the blood platelets gave a low count, although

[17] Berl. klin. Woch., 1891, No. 1.
[18] Deutsch. med. Woch., 1897.
[19] Volkmann's Samml. Klin. Vorträge, No. 203.

not abnormally so. In one case the alkalinity of the blood was not altered. The fibrin was normal in amount. In fact, it may be said that the microscope does not show a sufficient degree of abnormality in the numerical relationship between the corpuscular elements to account for the dyscrasia.

But whereas the morphology of the blood affords us no clue, on the other hand, we know that hemophilic blood has a prolonged coagulation time. In order to make clearer what I shall have to say on this point, let me for a moment revert to the coagulation of normal blood.

The coagulation of normal blood has always been a most attractive subject for investigation. The theories adduced from time to time are numerous, but, in the majority of instances, of little value. The one generally accepted at the present time is that the phenomenon is secondary to the formation of a fibrin ferment known as thrombin, the formation being dependent upon the presence of several different factors, namely calcium salts, prothrombin, and a zymoplastic substance. The calcium salts exist in solution in the plasma. The prothrombin may also preëxist in the plasma or may be furnished by the blood plates or leukocytes, or by both. The zymoplastic substance is derived from the cellular elements in the blood, the vessel wall, or the tissues. Delezenne has shown by very interesting experiments upon birds that when the blood is carefully withdrawn through a cannula inserted into an artery, the blood clots very slowly, and if centrifugalized at once the plasma will remain unclotted for days. If, however, while it is being withdrawn the blood comes in contact with the tissues, those about the wound, for instance, it will clot quickly. Thus it seems evident that in the bird the normal clotting of blood depends upon its coming in contact with the cut tissues. Several theories have been advanced to explain why blood does not coagulate within normal vessels. First, it is assumed that since the formed elements, leukocytes, and blood plates do not disintegrate, one of the principal factors in the formation of thrombin is wanting. Injury to the inner coat of the bloodvessel, the introduction of other foreign substances, and of macerated leucokytes will all precipitate coagulation, for by any of these means, through the destruction of tissue or the blood cells themselves, the formation of the prothrombin and the zymoplastic substance is rendered possible.

For the maintenance of the fluidity of the circulating blood Marowitz supposes the existence of an antithrombin body in it or in the endothelial cells of the vessel walls. If this antibody theory were proved to be correct, an overproduction of this substance in hemophilia might be assumed with some amount of plausibility.

Now, so far as hemophilic blood is concerned, practically in

all instances in which proper measures have been employed, a prolonged coagulation time has been observed, although, inasmuch as different observers using different instruments have obtained different times, a statement in minutes is of little value. It is unfortunate, from the standpoint of exactness, that we have not at our disposal a coagulometer of greater precision than those now in use. The one employed in the study of my case was the Boggs modification of the Brodie-Russell instrument, which seems to fill the requirements better than any of the others with which I am familiar.

In taking the coagulation time in a hemophiliac during a hemorrhage, Sahli observed the following points: The blood was not deficient in fibrin; the blood flowing over the clot outside the wound clotted rapidly, probably owing to the fact that it took up the fibrin factors from the clot; during a hemorrhage of any extent the coagulation time of the blood from another part of the body was shorter than for the same individual under ordinary conditions; after the hemorrhage was arrested the coagulation time shortly reverted to what it was under ordinary conditions. This seems to show that the blood in hemophilia reacts in the same manner as does the blood of a normal individual. It has also been noted that the hemorrhage in hemophilia is prolonged not so much because the blood fails to clot on the surface of the wound as because the bleeding continues beneath the clot, and because the latter does not extend into the vessels.

From these observations it seems that normally the clotting of blood depends upon the action of certain zymoplastic substances derived from the vessel walls as well as from the tissues, and that in hemophilia this substance is certainly deficient in both localities and probably markedly so in the vessel walls. The occurrence of subcutaneous, renal, and joint hemorrhages are to be explained by the same lack of chemical substance in the capillary endothelium which allows the blood to permeate more readily. It is possible, of course, that the deficiency lies in the chemical composition of the blood cells themselves or in the blood-making organs, but as we can ascertain no change in the blood by microscopic examination, it does not seem unreasonable to assume that it is in the vessel walls that the trouble lies, and especially as we have an analogous condition normally in the bird. Moreover, hemophilic patients in many instances manifest a marked hemorrhagic tendency from one locality only, which would seem to indicate a condition approximately normal elsewhere in the vascular system.

Prognosis. The outlook is unfavorable in most instances. The disease usually manifests itself before the second year and frequently during the first six months. Only in very rare cases has the hemorrhagic tendency been delayed later than the twenty-first

year. Statistics show that about 60 per cent. of these individuals die before the eighth year, and only about 11 per cent. reach maturity. After forty years of age the tendency to hemorrhage diminishes and may entirely disappear.

TREATMENT. As a prophylactic measure bleeders should be advised not to marry, although in the case of males of these families, themselves not bleeders, it may be permissible. Nurslings in whom there is a suspicion of hemophilia should be carefully guarded from even slight injuries, and should not be subjected to any operative procedures; even the application of leeches, blisters, and cups is contra-indicated.

Tonics and a liberal diet with good hygienic surroundings seem the best treatment for the dyscrasia. Vegetarianism and other restricted diets avail nothing. So far as we know there are no drugs which exert any marked influence in correcting the condition. All of the so-called styptics—such as ergot, lead acetate, and silver nitrate—have been employed, but without effect. Calcium lactate exerts a beneficial effect, but only for a short while, after which, in spite of its continued use, the coagulation time again lengthens. Consequently, as soon as the time begins to lengthen the quantity given must be greatly increased, or the drug may be discontinued entirely for a few days, after which its administration will again shorten the period. This point is well demonstrated in the case that I have to report.

The best results in local hemorrhages are obtained from the employment of sterilized gelatin or adrenalin compresses or simple pressure. Sterilized solutions of gelatin injected subcutaneously have also proved efficacious. During pregnancy in hemophilic women any indication of hemorrhage would warrant the induction of artificial labor. If the patient will not consent to this radical procedure, general tonic treatment and the administration of calcium lactate a day or so before the expected confinement will probably give the best results.

Hemophilic joints should be treated with pressure and afforded absolute rest. If the hemorrhage produces great tension, paracentesis followed by the injection into the joint cavity of a solution of adrenalin chloride is advised. This, however, should be the extent of the operative interference. Cases are on record in which hemophilic joints have been opened with fatal hemorrhage resulting, the condition having been mistaken for tuberculosis.

Massage is advised by Gocht, to be cautiously begun a few days after the development of the effusion, not over the joint itself, but over parts slightly distant. This procedure has for its object not only stimulation, but also prevention of the muscular atrophy so frequently seen. When the condition has reached the stage at which there is much thickening of the capsule of the joint, massage with very gentle passive motion is indicated. Force is

contra-indicated in all joint complications in cases of hemophilia. For subluxation suitable braces are to be employed. Hoffa gives very minute instructions as to the management of these cases.

The treatment of the hematuria is extremely unsatisfactory. The ordinary styptics have little or no effect. If general hygienic and tonic treatment is without avail and the patient's condition is going from bad to worse, nephrotomy has been advised and performed in some cases with curative results. Primary nephrectomy is not indicated. Harris[20] reports two cases of so-called essential renal hematuria, and has collected sixteen similar instances from the literature.

The case which I have to report is as follows: D. J. B., aged forty years, a native of the United States, unmarried, a freight conductor. The mother and father are both living at an advanced age. The father gives a hemophilic history from boyhood until the age of twenty-three years, after which time he seems to have outgrown the tendency. One paternal uncle is similarly afflicted. Two paternal uncles and one paternal aunt are not bleeders. The paternal grandmother was a hemophiliac and died of hemorrhage during confinement, aged thirty-nine years. The father's maternal aunt was not a bleeder, but several of her children were. The patient has one brother who is not a bleeder, and one sister who was a bleeder and died at the age of eight years, but not of hemorrhage. Two brothers have a history of repeated and excessive bleeding from the nose and lips during boyhood. They are now thirty-four and thirty-eight years old, respectively, and seem to have outgrown the tendency. Several of the patient's first cousins are bleeders, although their histories are somewhat indefinite.

As a child the patient had measles, but no other disease, so far as he knows, and, with the exception of a gonorrhœal infection later in life, has had no serious illness. He is not addicted to the use of alcohol or tobacco. When a child he had frequent attacks of epistaxis, the hemorrhage being so severe at times as to cause fainting. These attacks continued to be severe until he was about fifteen years of age; since then they have grown less severe, though only slightly less frequent. He has cut himself on the hands and feet from time to time since early boyhood, but never bled to the fainting point, though there was always difficulty in arresting the hemorrhage. He has never had hematuria or joint manifestations. In 1902 he was operated upon for an ingrowing toenail, and nearly bled to death. It was at this time that he first became aware of his hemophilic inheritance. On August 24, 1907, he had a curious abdominal attack which was diagnosticated as "Henoch's purpura(?)" The attack was associated with general

[20] Phila. Med. Jour., March 19, 1898.

abdominal pain and distention; there was no marked muscle spasm in the right iliac fossa, and no especial point of tenderness. Examination of the blood at this time showed the hemoglobin to be 80 per cent., the leukocytes 9800. The differential count of 276 cells showed: Polymorphonuclears, 71; large mononuclears, 7; small mononuclears, 21; eosinophiles, 0.3; mastzellen, 0.7 per cent. The leukocytes the following day were 10,000. Examination of the abdomen showed purpuric spots over the site at which the ice had been applied. The symptoms abated from this time on; the temperature was never higher than 100.2°, the pulse was 80. The patient was discharged from the hospital September 10, 1907.

The present illness began in the latter part of January with the usual premonitory symptoms of typhoid fever, namely, loss of appetite, progressive weakness, headache, slight fever, some diarrhœa, and vomiting; there was nose-bleeding almost daily. He was taken to the hospital February 2. At this time his temperature ranged about 102.5°, six days later reaching 103.6°. The temperature behaved as in an ordinary case of typhoid, reaching normal February 22, but rose the following day to 100°, about which point it hovered until February 29. The evening temperature did not permanently fall to normal till March 23. The pulse was always good, dicrotic at times, the rate never higher than 110. Rose spots appeared about February 8. A positive Widal reaction was obtained February 15. Nose-bleed occurred once on February 11, 22, and 26, and March 1, 4, and 10. The vomitus contained bloody mucus February 8, which was probably from the nasopharynx. There was no blood in the stools at any time. On February 12 the red blood corpuscles numbered 3,952,000; the hemoglobin on February 12 was 70 per cent., on February 26, 60 per cent; on March 4, 50 per cent.; March 11, 65 per cent.; May 1, 78 per cent.; May 12, 80 per cent.

The coagulation time when first taken was eighteen minutes, the normal limits with the Boggs instrument being from six to eight minutes. By the administration of calcium lactate the time could be reduced to nearly normal by the end of the third or fourth day, after which the time would begin to lengthen in spite of its use. The drug was therefore administered for three days, or until the time began to lengthen; it was then discontinued until the time reached twelve minutes, when it was again administered. In this way the time was always kept within twelve minutes, and often down to seven or eight minutes. The patient was discharged from the hospital April 2, in good condition. The coagulation time on May 12 was fourteen minutes.

The points of interest in connection with this case are: (1) The inheritance came through the father, who was himself a bleeder; (2) this is the first case, so far as I know, of typhoid fever reported in a bleeder; (3) a case of typhoid fever may be brought to a suc-

cessful termination in a patient so afflicted; (4) no hemorrhages occurred from the intestinal lesions; (5) the successful termination in this instance was probably in a large measure due to the fact that at or about the age of forty the hemorrhagic tendency abated; (6) in this man's case the principal manifestation of the hemorrhagic tendency had been attacks of epistaxis, the only other serious hemorrhage having occurred at the time of the operation upon his toe. Whether the careful administration of calcium lactate is really of substantial benefit can only be determined in the future after trial in a relatively large series of such cases.

THE ETIOLOGICAL FACTORS OF COMPRESSED-AIR ILLNESS.

THE GASEOUS CONTENTS OF SUBAQUEOUS TUNNELS; THE OCCURRENCE OF THE DISEASE IN WORKERS.

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Among the great engineering feats of the past ten years, perhaps none has been greater than the building of the subaqueous tunnels under the East River, New York City. In this work man has to contend not only with the dangers of ordinary tunnel construction, but also with those of compressed-air illness, or "bends," a disease or condition to which all workers in compressed air are liable. The word "bends" has come into vogue among the workmen because of the supposed characteristic attitude assumed by these sufferers in their efforts to relax the affected muscles and to relieve the pain. These cramps may occur in a group of muscles, such as those of the abdominal wall or of the extremities, and frequently the pains are referred to the joints.

Compressed air is, of course, necessary in subaqueous tunnel construction, for it supports the river bottom, which the work of excavation leaves partly unprotected, and thus prevents the river from flooding the tunnel. The amount of air pressure required varies greatly and is dependent upon the depth of water above the tunnel. The pressure necessary may be roughly estimated at fifteen pounds to every thirty feet of water.

It has been suggested by Snell,[1] E. W. Moir, Leonard Hill,[2] and others that certain gases, when present in compressed air tunnels, may influence the number of cases of "bends." The purpose of this paper is to describe these gases, particularly carbon

[1] Compressed-air Illness, London Magazine, 1896.
[2] The Junior Institute of Engineers, 1907, xviii, 65.

dioxide and carbon monoxide, and also to describe other atmospheric conditions found in subaqueous tunnels and the effect these have in the etiology of compressed-air illness, or "bends." I wish also to demonstrate the prevalence of "bends" among new men, those subjected for the first time to high atmospheric pressures. An analysis is attached of one air sample taken from the right auricle of a man who died of compressed-air illness, which analysis is believed to be one of few, if not the only one of its kind.

Two and one-half years' experience as one of the medical officers on the staff of S. Pearson & Sons, Incorporated, constructors of the Pennsylvania Railroad East River Tunnel, gave me unusual opportunities for observation and study in this line, owing to the magnitude of the work. The observations on air analysis embodied in this article are based on results obtained from daily records of the four tunnels. During the year 1907 a special chart was kept, giving in detail the daily air analyses, the number of men at work, the amount of air pumped into the tunnel, and the air pressures.[3] Estimations were first made of carbon dioxide.

CARBON DIOXIDE (CO_2). *Properties.* Carbon dioxide, colorless at ordinary temperatures; slightly acid taste and odor; incombustible and not supporting combustion; heavier than air, specific gravity, 1.529.

Source. Normally CO_2 exists in only the most minute quantities, excepting in pockets of coal (fire-choke); in the vicinity of certain mineral springs or active volcanoes; as a by-product in fermentation, decomposition, and putrefaction of organic matter; and is formed in human or animal respiration, and in blasting.

Effect on Man. Carbon dioxide is in no way a poisonous gas. This has been proved by the experiments of Leonard Hill and others. That when present in large quantities in the air we breath it will cause death, is an undoubted fact; but death is then caused by suffocation, as in drowning, from the absence of oxygen. Authorities differ as to the permissible amount of CO_2, but as most tunnel contracts call for air containing not over 0.1 per cent. of CO_2, we shall consider this as our standard. This figure is most conservative, in fact, seemingly unnecessarily so.

Detection of CO_2 in Air. The percentage of CO_2 is most commonly determined with the Palmquist apparatus[4] or by the Hesse method.[5] All the analyses for CO_2 in the tunnels were made with the Palmquist apparatus. Although this apparatus is not absolutely accurate, the results were made fairly so by checking them with those obtained by Hesse's method.

Normal air contains CO_2 in very minute quantities. The amount varies, being high in large cities, while in remote country districts

[3] I am greatly indebted to Professor J. Livingston R. Morgan, of Columbia University, for his invaluable assistance and the use of his laboratory during the summer of 1907.

[4] Hempel's Gas Analysis, 1902, p. 363. [5] Ibid., p. 337.

CO_2 is practically absent. For New York City in the vicinity of the East River tunnels the average amount was 0.0363 per cent. by volume.

Compressed air taken directly from compressors contains CO_2 in slightly larger quantities than does normal air, averaging about 0.0423 per cent. by volume. This difference, 0.006 per cent., between compressed and normal air is so minute that it is of no consequence.

The Source of CO_2 in Compressed-air Tunnels. In subaqueous tunnels CO_2 might be traced to any or all of the following sources: (1) Decomposition, putrefaction, or fermentation of organic matter. This source of CO_2 contamination was eliminated by comparing the analyses of samples of air taken in the tunnels which were temporarily not being worked, and of samples of the air supplying the tunnels. These proved to be practically the same. (2) Respiration in man consists in inspiring oxygen, nitrogen, and other gases in minute quantities, and in expiring carbon dioxide, nitrogen, oxygen, and an indeterminable amount of foreign matter, which may or may not be noxious. The increased CO_2 in expired air represents a corresponding amount of O_2 lost from inspired air. Therefore, if this air be not constantly changed, CO_2 becomes of immediate importance, and suffocation will rapidly ensue, not from the presence of CO_2, but from the loss of oxygen. Pettenkofer[6] suggests that carbon dioxide is a good index of the amount of deleterious substances given off by expiration, and as we are not able to determine these substances accurately, we may gauge the purity of the air by the percentage of carbon dioxide present. (3) Blasting will be described more fully under carbon monoxide. It is sufficient for the present to know that carbon dioxide is one of the gases given off. Analysis of a sample of air from a "heading," taken immediately after a blast, showed the CO_2 to be as high as 0.657 per cent. by volume, while ten minutes later a sample taken in the same place showed only 0.07 per cent. by volume, and half an hour after a blast the air contained the same amount of this gas as it did before. Therefore, the presence of carbon dioxide in the air of the tunnels is due practically to human respiration.

Air samples were taken daily in the tunnels, and in order that these analyses might be general, the samples were collected at several points, namely, in front of and behind the "shield," in the "pockets" of the shield, and at four or five places throughout the length of the tube.

The following figures are compiled from several thousand CO_2 readings, taken during the year 1907, of samples of air from behind the "shield" where a number of men were always at work, and they therefore show a fair maximum average for the four tunnels: Maximum, 0.1 per cent. by volume; minimum, 0.045 per cent. by volume;

[6] Hempel's Gas Analysis, 1902, p. 336.

average, 0.07 per cent. by volume. Since in our tunnels the amount of carbon dioxide in the air seldom if ever exceeded 0.1 per cent. by volume, it is my opinion that this gas has not the slightest influence on compressed-air illness. In substantiation of this view, it was found that on the charts of the four tunnels in which the daily CO_2 fluctuation and the number of cases of "bends" were recorded, the amount of CO_2 bore no relation to the number of cases of illness.

Carbon Monoxide (CO). Carbon monoxide (CO) is a colorless, odorless, combustible gas, lighter than air; specific gravity 0.967. This gas, aside from being explosive, combines readily with hemoglobin, forming a most stable compound, and thus preventing oxygen from being carried to the tissues, and eventually causing death by suffocation. For these reasons CO has always been considered one of the most dangerous of gases.

In taking up the work of determining small quantities of CO in high-pressure tunnels, some simple method was the first consideration, and an equally simple, effective, and practical method for the collection and preservation of the air sample. An air cylinder suggested by Professor Morgan, of Columbia University, was made, and proved to be most satisfactory. Samples collected up to thirty pounds gauge pressure and over were kept for more than a month without loss of pressure. The cylinders were made of copper, and caps of the same material were screwed in place and braized. At either end were compression cocks fitted with leather gaskets. Of the two, one was so arranged that a pressure gauge might be attached, the other was drawn out and corrugated for rubber tubing which connected with the CO apparatus. The capacity of each cylinder was accurately determined to be from 1035 to 1045 c.c.

A study of the writings on this subject showed that very little had been done in determining small quantities of carbon monoxide. The ordinary method of quantitative CO determination was by the use of some apparatus such as Orsat's,[7] the principle of which is absorption of this gas by cuprous chloride. This apparatus is very simple to manipulate, and gives CO readings within 1 per cent. It is generally used in determining the amount of CO in flue and illuminating gas, but it is of no value in determining minute quantities. The other, a more delicate but purely qualitative method, was the spectroscopic examination of the blood for carbon monoxide hemoglobin. Kinnicutt and Sanford[8] devised a very accurate method of determining small quantities of CO, and a simple modification of this by Professor Morgan and myself[9] is the one upon which all these determinations are based.

The presence of CO in the East River tunnels might be traced

[7] Hempel's Gas Analysis, 1902, p. 257.
[8] Journal of the American Chemical Soc., 1900, xxii, 14. [9] Ibid., 1907, xxix, 1589.

to any or all of the three following sources: (1) A large gas tank immediately adjoining the works. A sample of air taken in this neighborhood showed no CO. (2) Flue gas. None was found at "intake flues" for compressors. (3) Blasting. This was carried on very extensively during the rock boring period of the tunnel construction, and to this we must trace our supply of CO.

In the blasting the explosive used was dynamite, the active principle of which is nitroglycerin. Dynamite in exploding liberates certain gases. Under the most favorable circumstances the gases liberated are CO_2, N_2, and O_2. When the dynamite is of inferior grade, however, when it is damp, or when for any other reason there is incomplete combustion, the gases given off besides those already named are CO, NO, CH_4, H_2, and H_2S, in amounts dependent upon the amount of incomplete combustion. The amount of CO given off in explosions of dynamite varies greatly. It may be in very small percentages or as high as 36 per cent., or even higher.[10]

Before the quantitative method of CO determination was perfected, spectroscopic examinations were made on two blood samples through which tunnel air had been passed. These are inserted, since I feel they help to prove that CO in small quantities is not to be detected by spectroscopic examination.

The two following spectroscopic blood analyses were made by Dr. T. W. Hastings at the Cornell University Medical College, New York City.

First Report: Dynamite used, amount 11 pounds 13 ounces. Absorption solution: 5 c.c. human blood, fibrin extracted; 20 c.c. distilled water; 1 gram ammonium oxalate. Through this solution, air in No. 1 tunnel "centre pocket," one minute after firing, was allowed to circulate for ten minutes.

"*Spectroscopic analysis.* (1) Blood exposed to air in heading after blast. Dark brownish red in color. Spectrum of methemoglobin; reduces with ammonium sulphide. No trace of carbon monoxide hemoglobin. (2) Control solution bright red in color. Spectrum of oxyhemoglobin; reduces with ammonium sulphide. Normal blood."

Second Report. Dynamite; very heavy blast, amount not known. Through 500 c.c. of oxalated bullock's blood, 4 liters of tunnel air, taken in heading and directly after blasting, was allowed to circulate. The air sample was allowed to circulate very slowly through the blood solution, the time consumed being one hour and forty-five minutes.

"*Spectroscopic analysis* (August 14, 1907). Oxyhemoglobin (by scale); reduces to reduced hemoglobin. Carbon monoxide hemoglobin not detected."

[10] A more complete description of gases given off in explosions may be found in Foster and Haldane's work, The Investigation of Mine Air, 1905, pp. 133, 134.

In this last blood examination it will be seen that tunnel air at its maximum CO saturation was allowed to circulate for one hour and forty-five minutes through the blood solution. This is a most abnormal condition, and one to which no tunnel worker is subjected, as will be demonstrated later, yet, as shown in the above report, no CO hemoglobin was found.

The following CO determinations are selected from the analyses made (during the year 1907) in the four tunnels. They show what small percentages really were present in those tunnels; but in land tunnels with poor ventilation and heavy blasting, it will readily be seen, as explained later, how rapidly CO might accumulate, in percentages high enough to be of grave concern.

1. Dynamite, 6 pounds 7 ounces, fifteen minutes after blasting: CO=0.01 per cent by volume.

2. Very small blast, ten minutes after firing: CO=0.0075 per cent. by volume.

3. Dynamite, 41 pounds 13 ounces, immediately after firing: CO=0.031 per cent. by volume.

4. Dynamite, 45 pounds 1 ounce, immediately after firing: CO=0.0423 per cent. by volume.

5. Second sample same as No. 4, but one minute after high pressure air line had been opened to clear heading: CO=0.02 per cent. by volume.

6. Sample taken ten minutes after firing of a very heavy blast, the amount of dynamite not known: first sample, CO=0.045 per cent. by volume; second sample, CO=0.05 per cent. by volume.

7. Dynamite, 5 pounds 15 ounces, immediately after blasting in "sump"—pumping chamber built in rock between tunnels—very confined: CO=0.015 per cent. by volume.

All these samples, with the exception of No. 7, were taken as near as possible to the "heading" where the blasting had taken place, and represent the highest percentage of CO obtainable.

A very fair average of the amount of CO present during the blasting period was about 0.025 per cent. by volume. This naturally varied according to the amount of dynamite used, its quality, and the completeness of its combustion. The percentage given above was not an average percentage throughout the tunnel, but that found in the heading after blasting. As these samples were taken immediately or very shortly after blasting, they represent the very worst atmospheric conditions. Until the "heading" is cleared by means of either the "blow pipe," a large eight to twelve inch suction pipe communicating with the normal air in the shaft, or the high pressure "air line," which clears the heading by blowing back into the tunnel all gases and smoke, the men do not resume their work. Both methods of "clearing the heading" are very effective, for in samples taken one hour after blasting it was impossible to determine CO in quantities over 0.002 per cent., the minimum detectible by our

method. The practice of clearing the "heading" in poorly ventilated rock tunnels by blowing the smoke and gases back into the tunnel, although a rapid method, can hardly be recommended for even the small amounts of CO given off by each blast will in time accumulate in sufficient quantities to be toxic.

Vogel,[11] who first described the spectrum of CO-hemoglobin, and, later, Gustav Walffhugel[12] state that in their opinion "quantities less than 0.25 per cent. of CO may be disregarded from a hygienic standpoint." (This figure, in the light of more recent investigations, is shown to be much too high.) Harrington[13] says that CO in quantities less than 0.25 per cent. will cause poisoning, and that "1 per cent. is rapidly fatal to animal life." Foster and Haldane[14] say, "Anything above 0.15 per cent. must be regarded as distinctly dangerous, and probably anything over 0.03 per cent. (CO) would in time produce symptoms distinctly felt on exertion." C. H. Wolf[15] claims to have demonstrated CO-hemoglobin in atmospheric air containing not over 0.03 per cent. CO. In the spectroscopic report made by Dr. Hastings the amount of CO must have been fully 0.03 per cent., but no CO-hemoglobin was demonstrated.

As the maximum amount of CO in our tunnels never exceeded 0.045 per cent., and as this quantity was present for only a very few minutes immediately following the firing of a blast, one could hardly expect this to influence in any way the number of cases of bends, and this was further substantiated by the complete absence of any clinical signs of CO poisoning. As further proof it may be added that in a chart kept of the same tunnel, first, when blasting was being carried on very extensively, and second, when there was no blasting, the air pressures and the number of men at work being the same, the cases of bends were practically equal.

Certain of the men did, however, complain at times of headache after a very heavy blast. These were always men who went ahead with the high pressure "air line" to clear the heading, or who were there for some other purpose. As these headaches were never accompanied by any other symptoms of CO poisoning, such as dizziness, shortness of breath, or muscular weakness, and as the headache disappeared when the heading cleared up, I do not regard them as a sign of CO poisoning.

Other Gases Found in Tunnels. At various times during the year 1907 samples of tunnel air were analyzed to determine if possible the presence of any one or more of the following gases in quantities sufficient to be dangerous: Methane (CH_4), sulphuretted hydrogen (H_2S), and nitric oxide (NO). I used a Hempel's gas analysis apparatus[16] which was especially constructed to read small

[11] Hempel's Gas Analysis, 1902, p. 217.
[12] Ibid., p. 217.
[13] Principles of Hygiene, p. 218.
[14] Investigation of Mine Gas, 1905, p. 133.
[15] Hempel's Gas Analysis, 1902, p. 222.
[16] Hempel's Gas Analysis, 1902,p. 59.

percentages of gas, the burette scale reading to $\frac{1}{100}$ of a cubic centimeter. The results of this work were mostly negative, for methane was never found, while nitric oxide and sulphuretted hydrogen were present only occasionally and in the most minute quantities.

Waste Matter, Aqueous Vapors, and Temperature in Tunnels. The amount of waste matters such as oil from compressors or any other organic or inorganic matter that might be forced through the air feed pipes, was relatively small, as was proved by the amount of deposit on the gauze screens at the mouth of the feed pipes.

The amount of aqueous vapor in the tunnels was very high, generally to complete saturation. Occasionally this would vary for short periods, and was dependent upon the amount of air leakage. Hygrometers left in tunnels never registered below 90° of saturation.

The temperature in the tunnels varied with the amount of air pumped in to maintain the required pressure, its length, and the time of year, averaging about 75°.

Ventilation. In order to maintain perfect ventilation it is generally conceded that from 2000 to 3000 cubic feet of fresh air per man per hour is more than sufficient. In the East River tunnels this amount was always exceeded, as the average amount of fresh air per hour was about 231,000 cubic feet, or about 7699 cubic feet per man per hour.

In connection with these determinations of the gaseous contents of the tunnel air, it is of interest to note that of a sample of air obtained from the right side of the heart of a man who died of "bends." The sample was collected at autopsy about five hours after death, by the following method: The pericardial sac was filled with water and an aspirating needle, which was connected with a specially devised air collector, was introduced under water into the right auricle, great care having previously been taken to displace by water all air in the collector tubing and needle. About 5 c.c. of gas was collected—much more could have been obtained if desired; and a quantitative analysis was then made.

The following report was made by Floyd G. Metzger, Ph.D., at Columbia University.

"New York, November 20, 1907. Certificate of Analysis. The sample of gas from S. Pearson & Sons, Incorporated, marked "Sample taken from right side of heart," submitted to me for examination, contains: Nitrogen, 80 per cent.; carbon dioxide, 20 per cent.; oxygen, immeasurable quantity."

Analysis of gases from normal venous blood:[17] From 100 volumes may be obtained: Nitrogen, 1 to 2 per cent.; carbon dioxide, 46 per cent.; oxygen, 8 to 12 per cent.

[17] Foster, Text-book of Physiology, 1900, p. 447.

In comparing the two analyses one is naturally struck by the great difference in the two samples. This may be explained as follows: The nitrogen which goes into solution under pressure remains unchanged, and is given off with carbon dioxide in the venous circulation as bubbles when normal atmospheric pressure is reached, and collects in large quantities in the right heart. The absence of oxygen is probably due to its having combined with the body tissues either before or shortly after death.

In a fatal case of "bends," if the man has been recompressed several times and does not die until twelve hours after the beginning of the attack, or if the autopsy is not performed within twelve to twenty-four hours after death, air in any considerable quantities is, as a general rule, seldom found; but when a man dies shortly after coming out of pressure, the right heart is almost invariably greatly distended with gas, and the whole venous system contains many bubbles.

FREQUENCY OF THE DISEASE AMONG NEW WORKERS. Having considered the insignificance of the variation of the individual gases as a causative factor of "bends," I now take up the frequency of this disease among new workers.

Examining Men for Tunnel Work. Before going to work all men were given a rigid physical examination. In the case of green and new men, besides this examination they were sent in charge of a competent man for a test of one and one-half hours in the tunnel. On coming out, they were brought back to the doctor's office and reëxamined. If any changes were noted in their condition, they were excluded from tunnel work. Of the many thousands of men who went into the tunnels for the hour and a half test only one was known to have had the "bends."

Length of Shifts of New Men. After a new man had passed for tunnel work, his first day consisted of part of one shift, instead of one whole shift; that is, six hours on an eight-hour shift, four and a half hours on a six-hour shift.

Prevalence of "Bends" Among New Workers. It has been stated by McLeod[18] and others that old compressed-air tunnel workers are just as susceptible to "bends" as are the new men. This in our experience was far from being the case, as will be shown later, in the results collected from charts of the four tunnels kept during the year 1907, at the New York City end. On these charts a distinction is made between absolutely new compressed-air workers and those who for some reason claimed previous experience. In the latter class a large percentage really were new workers in high pressures, for some had been away from this work for a long time; others had worked in but very low pressures in caisson work; while undoubtedly many others had never been near a pressure tunnel.

[18] Assoc. of Engineering Soc., 1907, xxxix, 301.

The Amount of Air Pressure in East River Tunnels. During the year 1907 the air pressure in the tunnels varied, ranging from 26 pounds to 34 pounds above normal atmospheric pressure; a fair average during the year was about 29 pounds.

The Percentage of Compressed-air Illness Among Different Workers. The following table gives the number of men classified as: *Green men,* namely, those new to compressed-air work, *new men,* namely, those new in this tunnel; and *old men* (approximate), who entered for work in the New York side during 1907; also the number of cases of "bends" in each group and the percentage.

The numbers of cases of "bends" given for "green" and "new" men were collected from the histories of those attacked at the end of their first or second day's work in the tunnel. Of this number, the majority were affected at the end of the first day.

	No.	Cases of "bends."	Percentage.
Green men (new to this work)	308	48	15.5
New men (new to this tunnel)	641	60	9.4
Old men (days)	150,664	657	0.43

In our experience it was found that compressed-air illness varied with the pressure—the higher the pressure the more susceptible the men were to the disease. Particularly was this true of new workers, for at 27 pounds and under, comparatively few men were affected, while at 30 pounds and over a large percentage was attacked.

In endeavoring to explain the susceptibility of new men to high pressures, one must consider the abnormal conditions under which these men work. Man has become accustomed to live and work in a certain atmospheric pressure, normally about 15 pounds to the square inch. In compressed-air tunnels he lives and works in an atmospheric pressure of from 35 pounds to 45 pounds and over to the square inch, and until he has adjusted himself to his new environment, he is susceptible to compressed-air illness. That a man's body does adjust itself to this environment seems amply proved by the vast number of subaqueous tunnel builders alive today.

In closing, it may be mentioned that men working in low pressure, that is, those ranging from 15 to 20 pounds, and in shifts not over eight hours in length, are not at all liable to "bends." In fact, in our experience a case of "bends" at these pressures was extremely rare.

CONCLUSIONS. In this article an endeavor has been made to prove the following:

1. In subaqueous tunnels the loss of air by leakage is sufficient to maintain perfect ventilation, and, therefore, carbon dioxide, carbon monoxide, and other gases do not accumulate in sufficient

quantities to be considered as a possible etiological factor in the causation of compressed air illness.

2. The direct cause of compressed air illness is the presence of air bubbles in the circulation; these gas bubbles consist of nitrogen, carbon dioxide, and oxygen, of which nitrogen is in excess, for the reason that this gas is the chief constituent of the atmosphere, and also does not combine with any of the body tissues.

3. New workers are most susceptible to this disease until the body accommodates itself to this entirely abnormal condition of high air pressure; and, therefore, it is of the utmost importance that only young, healthy men should be allowed to do this work. New workers should, when feasible, be started in low pressures, from which in the course of four or five days they may graduate to become, as they are called, "high pressure men."

MYATONIA CONGENITA, OF OPPENHEIM.

OR CONGENITAL ATONIC PSEUDOPARALYSIS.

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The condition described as myatonia congenita by Oppenheim, of Berlin, and sometimes called Oppenheim's disease, seems to have found but little recognition in America, as no mention is made of it in recent text-books, be they of neurology, pediatrics, or internal medicine. And yet the first autopsy case was published by an American, Spiller, of Philadelphia, and since then a considerable European literature has sprung up around the subject. Possibly one reason for this apparent neglect is the similarity of Oppenheim's appellation to that of myotonia congenita, or Thomsen's disease, which appears invariably to be thought of when the name is mentioned. I may add that there is yet another condition unfortunately similarly named, "Myotonie der Neugeborenen und Säuglinge," of Hochsinger.[1] To avoid confusion, therefore, I have applied the name congenital hypotonic or atonic pseudoparalysis to the disease; this is merely a descriptive cognomen, the pathology being still unsettled.

Before proceeding farther, I shall give the history of three cases (from Oppenheim's Polyclinic at Berlin); the third[2] is somewhat

[1] Krämpfe bei Kindern, Die Deutsche Klinik, vol. vii.

[2] For permission to publish these case reports I am indebted to Professor Oppenheim.

exceptional, and is here published for the first time; the first and second are typical and have been already reported by me.[3]

CASE I.—Emma R., aged three and one-half years. The mother brought the child to the clinic because it could not use its legs since birth. The upper extremities have always been normal. The child is, in regard to its intelligence, normally developed. Pregnancy and parturition were nowise complicated. Labor was not prolonged. There was no cyanosis at birth, nor any injury nor acute disease since. Examination shows complete hypotonicity of the lower extremities. Neither patellar nor Achilles reflexes can be elicited. The child can flex the foot upon the leg, but only with much reduced strength. The upper extremities, though they can be voluntarily moved in all directions, also show some weakness. Only if supported on both sides can the child propel itself forward, and this with much effort. Because of the child's excitement, the electrical examination was not complete; but this much was ascertained, that the cruralis and obturator on the left side gave no reaction at all, while the peroneus showed decreased electric irritability.

CASE II.—W. J., aged four months. This patient was referred to us from the clinic of Professor Hoffa. The child was born at the normal time; the parturition was easy. There is no history of any trauma. The mother felt fœtal movements until just shortly before labor. The child was at the breast for five weeks, and was then artificially fed. No gastro-intestinal disturbances have occurred. Looks well nourished; the size is that of a normal infant of this age. With the exception of the fingers and toes, the child may have been paralyzed since birth. It moans while being examined and lies motionless. The skin on the legs appears in places slightly mottled and cold to the touch. The patellar reflexes are absent. Complete atony is present. The extremities, being placed in most uncomfortable positions, are left so. Even when irritated by pain (pinch or pin prick) no movement is made, or only very slight ones in the feet and toes, and very gradually. In the arms a similar atony exists. The forearm is bent, the hand pronated, and the fingers held together (slight secondary contraction). Only in the fingers does one see some slow active movements. Even upon pricking with the needle no movement is made. With inspiration the diaphragm is drawn well down, the ribs to which it is attached being thereby somewhat drawn in. The abdomen is distended, the umbilicus pouting. The abdominal reflex is absent. The child cannot as yet sit up. It can move its head. The movements of the eyes are normal. The large fontanelle is closed. The neck is short, but apparently there is no pathological condition here. The cervical spine shows lordosis

[3] Zur Differentialdiagnose der Poliomyelitis anterior acuta, Karger, Berlin, 1908.

and lies deep. The dorsal spine is somewhat kyphoscoliotic (doubtlessly congenital). Needle pricks are normally felt in the face. The electrical reaction shows a quantitative but no qualitative change in the muscles of the thighs. In using a strong galvanic current the muscles contract with rapidity.

CASE III.—A. A., aged one and one-half years, female. There is nothing of hereditary significance. The mother is said to have felt strong fœtal movements. Labor was normal at term, there was no instrumentation, and the child showed no asphyxia. In the fifth or sixth month the mother noticed that the child could not hold its head up, nor sit up (which it had already attempted). Then gradually the present condition developed. On further questioning it appears that the child never really kicked nor used its feet as the normal infant does. It therefore becomes doubtful whether or not the condition was entirely congenital or acquired. At any rate, it seems that an exacerbation occurred in the fifth or sixth month. The child looks well nourished, and has a healthy color. It appears intelligent, notices all that is being said or done. At present it cannot stand, or sit, or hold its head up. In the beginning it sucked well; this has become difficult. There is severe constipation. The head is normally shaped. There is no craniotabes; the fontanelle is closed. The child repeats single words normally. Hearing is good. The pupils react promptly; opthalmoscopically normal. There is a tendency to convergent strabismus. Movements of the facial muscles are normal. Breathing is somewhat snoring. When let go, the child just doubles up as if made of rubber. The head is balanced with much difficulty, and the slightest movement sends it over. Both upper extremities are flabby, lacking all tone, though some movements are to be seen here. The child should be able to raise the arms somewhat in the shoulder. At present, when raised, both limbs again fall back upon the table. In the hands and fingers constant movements are seen, which at first appear athetoid in character, but are certainly more in the nature of play impulses. No reflexes can be obtained. The legs are absolutely atonic. The patellar and Achilles reflexes are absent. A real plantar reflex is not obtainable, only an occasional contraction or extension if this region is irritated. The toe reflex (Bechterew-Mendel) on the left side is mostly dorsal; on the right also, but not constant. The limbs lie extended in extreme outward rotation. Passively lifted they fall back as if lifeless. Active movements are to be seen in the toes. If placed in a very awkward and uncomfortable position, the legs are brought out of this only slowly, and chiefly by movements of the feet. Even when stuck with a needle no lively movement or reflex can be obtained. Occasionally one notices a contraction of the quadriceps. The abdomen is distended. There

is no abdominal reflex. The muscles are hypotonic. The diaphragm appears to act normally. The atony of the muscles of the back is especially intense, but so also is that of the hip- and knee-joints. There is considerable adiposis, which masks the atrophy that may be present. There is divergence of the lower part of the thorax. Sensation appears to be normal. The thyroid cannot be distinctly palpated. The percussion note over the sternum is strikingly short. Electrical examination shows marked lessening of irritability for both currents in the lower extremities, less so in the upper. The facial muscles react normally. There is no reaction of degeneration anywhere.

Studying these cases, we find certain points in common—a rather extensive apparently flaccid paralysis, with absence of patellar and Achilles reflexes. In one there is vasomotor disturbance, in another slight atrophy, masked, however, by adiposis. Viewed thus far these cases might be taken for anteropoliomyelitis. A little closer analysis, however, will bring out certain interesting facts—namely, that Cases I and II with certainty, and Case III quite probably, date from birth, or, in other words, are congenital. Now, congenital cases of anteropoliomyelitis appear not to exist. The one case cited in the literature[4] belongs possibly to the group of cases I mean to describe[5] and has nothing to do with poliomyelitis, as two other children of the family were similarly afflicted (familial intra-uterine poliomyelitis!), and the paralysis was progressive—increased instead of decreasing, as is the rule in anteropoliomyelitis. Furthermore, there is no really degenerative atrophy present with reactions of degeneration. The paralysis which is extensive, especially in Cases II and III, has not gradually confined itself to an area smaller in extent than that which was at first affected, as is almost invariably the case in anteropoliomyelitis. Finally, on careful examination, one sees that some movements are present in the affected muscles, that we are not really dealing with genuine paralysis, but with an extreme condition of muscular atony. These muscles feel soft and doughy, and, excepting in the one case, not cold to the touch. We have, therefore, before us a symptom complex which deviates widely from that found in infantile spinal paralysis.

In 1900 Oppenheim[6] described a condition of general or localized atony of the muscles, concerning which he said he had found nothing

[4] A. Sevestre, Ref. Neurol. Zentral., November 9, 1900, S. 904 (Paralysie flasque les quatre membres et des muscles du tronc, etc., Bull. de la Société de pédiatria de Paris, Fév.-Mars, 1899).

[5] H. Oppenheim, Lehrbuch, p. 224.

[6] Ueber allgemeine und lokalisierte Atonie der Musculatur (Myatonia) im frühem Kindesalter, Monatsschrift f. Psychiatrie u. Neurologie, 1900, Band viii, Heft 3, p. 232. Ueber einen Fall von Myatonia congenita, Berl. klin. Woch., March 7, 1904, No. 10, p. 255; also Berliner med. Gesellschaft, Sitzung, February 24, 1904.

in the literature. These cases occurred within the first two years of childhood, and showed as especially characteristic a hypotony or even atony of the muscles combined with partial or complete loss of the tendon reflexes. The limbs, particularly the lower, were at times so flaccid that they could be shaken like flails. There was in all cases an impairment of active motion. When the condition was extreme, the limbs lay perfectly still, and it appeared as if complete paralysis obtained. But on more careful observation, one could note occasional contractions in various muscles, which, however, were feeble, and lacked sufficient energy to give locomotive effect. Less involved cases showed only hypotony and a marked weakness. In one case the muscles of the trunk and neck were affected, besides those of the limbs, so that the infant of eight months could neither sit up nor support its head. Even in so generalized a condition, however, the muscles of the eyes, tongue, and throat were unaffected, as also the diaphragm. The intercostals, on the other hand, appeared to be involved. The muscle felt flaccid and soft, and appeared to be thin, though one could scarcely apply the term atrophic. Electrical examination showed in the severer cases a considerable quantitative, though never qualitative, alteration, up to even complete disappearance of reaction. In mild cases the reaction was normal. In but one case tardy contraction, and this only in portions of the muscle, was observed. No abnormalities, so far as it is possible to judge in such young infants, were discoverable in the sphere of intelligence, sensory system, or special senses. The malady always appeared to be congenital. In its typical form it seems to be the antithesis of Little's disease.

Oppenheim thought the pathological factor of this condition was to be sought, not in the central nervous, but in the muscular system, which was probably retarded in its development—for not only was he able now and again to observe partial or complete return to the normal within the course of time, but because he never had occasion to notice this condition in older children. He did not think it had aught in common with progressive muscular dystrophy. He did not entirely exclude the possibility of disease in the anterior horn cells prompting the developmental inhibition of the muscles.

Shortly after other cases began to appear in the literature, two of Berti's,[7] and then one, the first with necropsy, of W. G. Spiller's.[8] This last case was a child of twenty-two months. The head, trunk,

[7] Contribuzione all' Atonia muscolare congenita di Oppenheim (Terza adunanza della sezione Emiliana della Società Italiana di pediatria, 4 Dez. 1904, in Pediatria, February, 1905, p. 134).

[8] General or Localized Hypotonia of the Muscles in Childhood, Univ. Penna. Med. Bull., 1905, xvii, No. 11. See also Bernhardt, Neurologisches Zentral., 1907, No. 1. Spiller, Ebenda, No. 11.

and extremities were affected. There was very great hypotonicity of all the limbs, especially the lower (which could be flexed so as to bring the thighs in close contact with the trunk, and the feet easily behind the head). The child could not stand, sit unaided, hold up its head, or hold anything in its hand. It had always been constipated. The faradic electrical response was retained. Besides convergent squint,[9] certain abnormal conditions of the internal eye obtained, which, as they have nothing to do with the general condition, need not further be considered here. The child died during fever of unknown cause. The autopsy, made twenty-four hours post mortem, showed absence of postmortem rigidity and a hypotonicity of the limbs as great as that during life. The muscles were flabby. Section of the calf showed fat 6 mm. in thickness, with very little muscle, and this paler than normal. There was hardly any muscle in the sole of the left foot. The subcutaneous fat over the triceps measured 3 mm. The brain weighed 980 grams; the dura was adherent. The spinal cord and brain were well developed; the anterior and posterior roots normal. Microscopic examination of the brain, cord, nerves, and muscles (made by Professor Spiller personally) showed normal cells in the anterior horns of the cervical and lumbar regions (thionin stain), and a normal condition of the nerve roots. No spinal meningitis was present. There was no degeneration in the pyramidal tracts. Marchi sections showed no degeneration. The optic nerves were normal (Weigert and Marchi). The nerve cells of the paracentral lobules appeared normal, but in the section Betz's cells were not numerous. Various nerve sections, differently stained, were normal. Muscles from the sole of the foot, back of the trunk, and the left calf had a hyaloid appearance, and those from the sole of the foot were striking because of the large amount of fatty connective tissue, and on account of the considerable increase in the nuclei of this tissue. The muscle fibers were small, those from the sole and the calf much smaller than those from the back of the trunk (the child had more power in the muscles of its back than in those of its lower limbs). The transverse striations were well preserved, the longitudinal not so distinct. Nerve fibers within the muscle from the sole of the foot appeared normal. The mesenteric lymph glands were much enlarged; the organs of the body were macroscopically normal.

This report strengthens the surmise of an inhibited development of the muscle fibers. Quite different, however, are the findings of Bing,[10] who examined a piece of excised muscle from a living child suffering from typical congenital myatonia. Examination

[9] This was the "ordinary concomitant convergent squint, and not an internal strabismus due to paralysis of the external rectus." (G. E. de Schweinitz, cited by Spiller.)

[10] Ueber atonische Zustände der kindlichen Muskulatur, Med. Klinik, 1907, No. 1.

of this muscle tissue showed, apart from probable increase in the nuclei, an absolutely faultless structure.

A report of the microscopic examination of the internal organs in Spiller's case was published by A. J. Smith.[11] The heart, pancreas, kidneys, liver, and bladder were normal. The thymus showed distinct intralobular sclerotic changes (fibrosis), with enlarged Hassal's corpuscles, and arteriosclerosis (thickening of the adventitia, occasional fibrosis of the intima, and proliferation of the endothelial cells). The spleen also showed sclerotic changes in various bloodvessels and endothelial proliferation of the Malpighian bodies. The mesenteric glands showed proliferation of the lymphatic cells.

A little patient whom I had occasion to examine with Stabsarzt Helmer, on the pediatric division of the Königlische Charité in Berlin, last year, also had this affliction. The diagnosis had been made by Dr. Reyher, who had sent the child in from the polyclinic, and who later, the child dying of pneumonia, examined some of the muscles microscopically.[12] His report to me was as follows: Side by side with patches of normal muscle fibers were extremely altered ones. The abnormality consisted in the cross-striation being indistinct or entirely absent. In some parts the longitudinal striation appeared to be lost. The individual muscle fibers varied very much in breadth, some being abnormally thin, others apparently abnormally broad. Where the changes were most pronounced there were but few muscle fibers to be found at all, fat and connective tissue rich in nuclei being seen instead. The changes were most marked where the clinical symptoms had been most manifest, as in the lower extremities. The long bones of the lower extremities showed considerable atrophy (which the Röntgen photogram had already shown in vivo). Then came the reports of a whole series of new cases, among which was one with necropsy.[13]

The patient was aged four months, of healthy parents (who also had another perfectly healthy four-year-old child). Parturition was normal. The infant never had had convulsions. From birth on, the neck, trunk, and all extremities appeared to be completely inert. The condition neither improved nor progressed. Examination showed a generalized flaccid paralytic condition, the muscles of bulbar innervation alone being exempt. At times a slight internal strabismus of the right eye was noticed. The facial muscles were normal. The infant sucked and swallowed well. Its cry seemed weaker than that of infants of like age. The muscles of the neck could not support the head. Those of the trunk lacked

[11] Histological Changes Encountered in the Thymus and Elsewhere in a Case of Congenital Hypotonia, Univ. Penna. Med. Bull., October, 1905.

[12] This case was to be published in full.

[13] A. Baudouin, La myatonie congénitale (maladie d'Oppenheim), Semaine médicale, May, 1907, No. 21.

all tonicity. The intercostals were also involved. Only in the fingers and toes did one notice movements, and these were very feeble. The feet showed varus, with slight equinus. All reflexes except those of the eye were absent. The skin, especially of the lower extremities, was wax-like and glossy, and showed a swelling resembling myxœdema. No other atrophic disturbances were present. Sensation, the sphincters, and the special senses were normal. There were no reactions of degeneration anywhere. The bony system showed neither signs of rickets nor syphilis. The child died of a bronchopneumonia, having had convulsions one hour before death. The autopsy was made twenty-four hours post mortem. The external aspect presented nothing of special interest. The muscles were pale and sunk in fat. There was considerable subcutaneous fat, in places 1 cm. thick. Microscopic examination of the nervous system showed much of interest. Sections from the convolutions of Rolando stained with the Nissl method were found normal. The nucleus of the third nerve (of both sides) was normal. That of the sixth and twelfth nerves was formed of cells well developed, many of which showed chromatolysis. Stained with the Pal and Marchi methods, the cord showed nothing abnormal. A section from the lower region of the eighth cervical segment stained with the Nissl method showed the cells of the anterior horns to be diminished in size and less numerous than normal. Those of the column of Clarke were well developed. The vessels were normal. No neuronophagia was observed. A similar condition was found in other parts of the cord. Baudouin concluded that there had been an arrest in the development of the anterior horns without any inflammatory phenomena.

A section of the anterior and posterior roots of the third lumbar segment showed a considerable difference between the thickness of the two, Normally the anterior is about one-half the size of the posterior. Here it was one-quarter to one-fifth the size. The posterior also stained much darker, the bundles of fibers having less amorphous tissue between them.

The sciatic, as an example of a peripheral nerve, showed no abnormalities by the Marchi method (no regressive or degenerative lesion therefor). The Weigert and hematein-eosin stain made manifest, however, that there were axone cylinders in the nerve not yet myelinated. There was also a slight sclerosis, and the nuclei of the sheath of Schwann were slightly more numerous than usual. The same condition was found in the crural, median, and cubital. Stained with osmic acid the right internal motor oculi is normal; the external, however, shows an absence of many myelin sheaths (the infant displayed occasional internal strabismus of the right eye). Here, too, Baudouin concludes there is an arrest in development and no neuritis. Finally, the muscle showed great changes. With weak magnification the predominating picture

was that of intense sclerosis. The stands of fibrous connective tissue within the muscle were numerous and thick. The vessels were also a little thickened, but especially interesting was the fact that they were surrounded by a zone of young cells which stained deeply, among which one noticed a rather large number of eosinophile myelocytes. As in the Charité case, one saw here bundles of very attenuated muscle fibers (measuring 6 to 8 microns) alongside of very thick hypertrophied ones (measuring 100 microns in diameter). The nuclei of the sarcoplasma were increased in number, and sometimes invaded the fiber itself. Longitudinal sections showed a disappearance of the transverse striation, the longitudinal being clear. The same picture was seen in the various muscles examined, the diaphragm, however, being the least affected. These lesions were, in Baudouin's opinion, of a regressive nature, such as one sees in the myopathies. Hystologically the skin was normal save that the subcutaneous fat was very abundant. The kidney, suprarenals, liver, and pancreas were normal. In the spleen there was a mild sclerosis. Some of the Malpighian follicles were a little more evident than normal. The thyroid presented intense sclerosis involving the acini, these being filled with cells and containing no colloid substance. No lymphatics could be seen. The thymus showed a similar sclerosis.

Finally, the gross and microscopic findings in the case of W. J. (Case III of my series) were reported by M. Rothmann[14] (in whose clinic the infant came to autopsy[15]). There was an absence of rigor mortis; the muscles all looked pale and thin. The subcutaneous fat was strongly developed. All segments of the cord showed extensive disappearance of the anterior ganglion cells, with increase in the capillaries, and atrophy of the anterior roots. In the hypoglossus nuclei there was beginning disappearance of the ganglion cells, with chromatolysis. The muscles showed atrophy and small-celled infiltration. Another case with necropsy was announced by MM. Variot and Devillers[16] at the Société de pédiatrie, October 15, 1907. Only a partial autopsy, it seems, was made; the results of the histological examination are still to be published.

Besides the case here communicated for the first time, some 34 or 35[17] cases have thus far been reported (Oppenheim 5, Berti 2,

[14] Dr. Rothmann had the kindness to write me, at the time the autopsy was made, that the macroscopic examination proved to be negative.

[15] Berl. med. Woch., November 12, 1908; Jahresver. d. Gesell. Deut. Nervenärzte, Heidel., 1908.

[16] Société de pédiatrie, October 15, 1907 (Archives de médecine des enfants, November, 1907, No. 11, p. 700).

[17] A case of Beevor's ([32]) is cited by Collier and Wilson under their bibliography. I have not, however, been able to locate it. The case of Schüller ([37]) was but poorly reported, and the diagnosis, therefore, indefinite. The same may be said of a case reported by Hutinel ([38]).

Muggia,[18] Spiller, Kund,[19] Rosenberg,[20] Jovane,[21] each 1, Sorgente,[22] Comby,[23] each 2, Tobler,[24] Bing, Leclerc,[25] Baudouin,[26] Misserey,[27] Cattaneo,[28] Variot,[29] Reyher and Helmholz,[30] each 1, Haberman 2, Lugenbühl,[31] Beevor,[32] Thomson,[33] each 1, Batten[34] 3, Collier and Wilson[35] 4). Three cases (2 by Bernhardt[36] and 1 by Schüller[37]) have been published under this heading, but do not in all probability belong here, while 1 (Carey Coombs[38]), though classed among the myatonic cases by Collier and Wilson, appears to me to be far too atypical to be accounted such. Another case (Wimmer[39]) resembles congenital hypotonic pseudoparalysis only in part, and is to be classed rather with the progressive spinal atrophies.

Studying the reports of these cases (and excepting for the time being those published in England—of which I shall presently speak) one may conclude the following: Neither sex predominates. Heredity was nil. Pregnancy and parturition were normal. In several cases fœtal movements were not felt, in others they were felt precisely as in former pregnancies. In most cases nutrition was very good. In many adiposis was noticed. These children were somewhat pale and flabby, growth was normal (in no case were symptoms of rickets noticed[40]). The muscles were soft and doughy, but were never reported as having been truly atrophic. In one case the lower extremities felt cool and looked mottled;

[18] Un caso di paralisi completa congenita dei quattro arti (I° reunione dei pediatrie Piemontesi, 12 Fev., 1903, in Pediatria, Mars, 1903, 179).

[19] Ueber Myatonia congenita (Oppenheim), Diss., Leipzig, 1905.

[20] Ueber Myatonia congenita (Oppenheim), Deutsch. Zeit. f. Nervenheilk, Band 31, 1906.

[21] Contributo clinico allo studio dell' atonia muscolare congenita di Oppenheim, La Pediatria, Mars, 1906, xiv, No. 3.

[22] Due casi di atonia muscolare congenita di Oppenheim, La Pediatria, 1906, No. 5, xiv.

[23] Atonie musculaire congénitale in Archiv. de Méd. des Enfants, 1906, Band ix, No. 9, 552; Société de Pédiatrie, October 15, 1907 (Archives de médecine des enfants, November, 1907, No. 11, 700).

[24] Ueber Kongenitale Muskelatonie Jahrbuch f. Kinderheilkunde, 1907, Band 66, Heft 1.

[25] Un nouveau cas d'atonie musculaire congénitale (Maladie d'Oppenheim), Gazette des Hôpitaux, December 10, 1907, No. 141.

[26] Loc. cit.

[27] Myatonie Congénitale ou Maladie d'Oppenheim, Thèse, Lyon, 1908. (Same case as Leclerc, No. 25.)

[28] Sulle paralisi dei neonati e sulla myatonia generalizzata di Oppenheim (Clinica moderna, June 13, 1906, 282).

[29] Loc cit.

[30] Provisional report at the Breslau Congress for Pediatrics, 1908.

[31] Ein Fall von Myatonia congenita, Deut. med. Woch., August 29, 1907, 1439.

[32] A Case of Amyotonia Congenita, Brain, 1907.

[33] A Case of Amyotonia Congenita, Brain, May, 1908, 160.

[34] Three Cases of Myopathy, Infantile Type, Brain, 1903, 147.

[35] Amyotonia Congenita, Brain, May, 1908, xxx.

[36] Zur Kenntniss der sogenannten angeborenen muskelshlaffheit, Neurol. Centralblatt, 1907, Heft 1.

[37] Wien. klin. Wochenschr., June, 1904, No. 25, 722 (Verien f. Psych. u. Neurol. in Wien, May 10, 1904).

[38] Congenital Hypotonia (Congenital Amyoplasia), Brit. Med. Jour., June 15, 1907, 1414.

[39] Archiv f. Psych und Nerv., No. 42, 1907.

[40] Rosenberg's case "should have had a light attack of rickets in the eleventh month," no symptoms, however, being present at the time of examination.

in four a myxœdematous condition of the skin was described. Otherwise no trophic disturbances were noticed. The cranial nerves were always normal (in Spiller's case congenital amaurosis obtained, probably of central origin, the optic nerve being found normal). Sphincters, sensory system, and intelligence were normal. In all the patellar reflex was absent, in some the skin reflexes also. The electrical response was very much diminished or entirely absent, but never qualitatively altered. In all cases the chief symptom was the immobility of the limbs—the inactivity of the child. It appears most probable that in all cases the condition dated from birth (the only doubtful cases being Case III, which I report, and which Professor Oppenheim also thought more probably congenital, and Rosenberg's, in which the atony was first noticed in the eleventh month—the mother, however, having scarcely felt any fœtal movements at all), and was in most cases noticed within the first few days after birth. In several it was only discovered later, when the first attempts at walking were made. In most cases it was found (in others the fact is not reported) that movements or "remnants" of movements were present even in the atonic muscles, if not active, then at least on pain-irritation. In a few, absolute immobility seemed to obtain (in Muggia's case in all four extremities, in Jovane's and Sorgente's cases only in the lower), and here no improvement occurred. In other cases in which at first no movement was seen this later became manifest.[41] One even noticed that the patellar reflex, and also single active movements set in temporarily after energetic faradization.

Many cases (12) showed improvement after long-continued treatment (Rosenberg reports improvement even after thirty-one months). In others no improvement occurred. In several cases the outcome is not known. In our third case an exacerbation was noticed in the fifth to sixth month. In no other case was the condition noticed to progress. In 11, death occurred immediately, due to pulmonary disease (pneumonia). Three cases had convulsions. This occurred in Sorgente's 2 cases (both of the same parents), in the one, tonic and clonic spasms of all the limbs five hours before death; in the other, generalized convulsions twice in the last twenty-four hours; in Baudouin's case, one hour before death. Sorgente's cases suggest that the condition may occur familialy.

In all the cases the lower extremities were affected; in more than half the upper also (though usually in lesser degree); in many the trunk besides; in five, also the head; in two, the diaphragm seemed affected; in three, strabismus was present; in one, the

[41] It may here be remarked that in some of the histories little attention was paid to these slight movements in the muscle groups, or the fact was not reported. In all cases which were carefully examined and minutely reported the fact is emphasised that nowhere did absolute immobility obtain, so that we may conclude that actual paralysis occurred in no case, only varying degrees of atony.

facial muscle appeared somewhat weak. Throat and cranial nerves, therefore, appear on the whole to be free. Never when movements were executed was coördination disturbed. Standing and walking were in no case possible. Most all showed a functional kyphosis usually very intense in sitting. In two, atrophy of the bones of the lower limbs was noticed. Once, secondary contraction (in the hand). The distal parts were always less affected than the proximal, and were even entirely free in several cases of severe proximal involvement. Slight cases showed hypotonicity only; severe cases absolute atony. In most cases the teeth showed no abnormality; in one or two, teething was late. Subjective symptoms do not appear to occur.

The majority of the cases reported in England (Batten, Collier and Wilson, Coombs, Thomson) are of older children (five to ten years of age). In most of these contractures were noticed (doubtlessly due to the long continuance of the disease). The affected muscles are defined as being small and thin, and the description suggests considerable wasting, even though no real atrophy should have occurred. In no case was adiposis present (this period of childhood being less prone to adiposis than the first two years). These authors emphasize the long, narrow, pad-like formation of the feet and hands. The joints are especially hyperextensive. Certain of these cases show discrepancies which make them somewhat doubtful. Thomson's evidently had a difficult partus (under chloroform). The mother complained of the child being drowsy. The hamstrings and adductors of the thigh did not appear to be affected (distribution?). There was little difference between CCC and ACC. Finally, the patellar reflexes were present, and the improvement was so rapid that the child could sit up and make attempts to walk after four months. One case of Collier and Wilson's was well up to the twelfth month. These authors speak of a prenatal type, and even assume the occurrence of this disease after acute illness in a previously healthy child. The major evidence as yet in hand is, I believe, against this inference. Coombs' case is certainly too atypical to belong here. The child was ten years old. The condition was first noticed in one hand, and only months after in the rest of the body. The distal muscles suffered more than the proximal. The scapulæ were winged. The knee-jerks were present and brisk. The Achilles phenomenon was also present.

The clinical picture of myatonia congenita is, on the whole, therefore, a typical one, and may roughly be landmarked as a congenital, atonic pseudoparalysis, met with in children in the first two or three years of childhood, in which the reflexes are very weak or abolished, electrical reaction reduced but never degenerative, real atrophy not met with, the distribution proximal, with no progression, the muscles of bulbar innervation practically exempt,

and no sensory, bladder, nor rectal involvement occurring. In a minimal group the children are older, contractures are present, the muscles small and thin (atrophic?).

Coming to the differential diagnosis of this disease, we must first consider those conditions in which we often meet with a high degree of muscular atony—namely, infantile or congenital myxœdema, mongolianism, and, above all, rickets. Among our cases we have, in fact, four (cases of Baudouin, Leclerc, Berti) which showed myxœdematous thickening of the skin: while in one (Baudouin's) the autopsy displayed gross changes in the thyroid gland. And yet I believe we may exclude myxœdema entirely. In the first place, this symptom complex is typical: the characteristic physiognomy; the small, widely separated eyes; the spare hair growth; the swelling about the face, forehead, and especially the eyes (regions not at all affected in three of the cases above referred to); the pallor or wax-yellow sallowness of the skin, and it's great dryness (often scaling); the thick tongue, usually protruding from the mouth; the umbilical hernia, obtaining in all cases of any severity; the persistent patency of the large fontanelle; the impaired psychic condition; the pronounced disproportion between length and breadth of the body; and finally, the fact that myxœdema is unusual in boys, and that only one of the myatonia cases observed (Baudouin's) bears the slightest resemblance to it. On the other hand, no condition described as arising actually or experimentally from thyroid insufficiency[42] has any likeness to Oppenheim's disease.

As regards mongoloid idiocy, it may be dismissed without comment, as it gives so typical a picture that it could scarcely be mistaken for anything else.

Rachitis, however, we must study more carefully, as this disease often evidences a high degree of hypotonicity, which may easily enough be taken for paralysis. Rickety limbs may occasionally be placed in all sorts of abnormal and uncomfortable positions without causing distress to the young patients. They may in some cases even be twisted about after the fashion of the circus "snake-man," strongly hyperextended and shown to be loose and wabbly like flails. This pseudoparalytic condition occurring in rickets has been described by Oppenheim,[43] Comby,[44] Vierordt,[45] Hagenbach-Burckhardt,[46] and Bing.[47] One may also find a slight muscular

[42] Ewald in Nothnagel's System, Band xxii; Kassowitz, Infantile Myxœdem, etc. Vienna, 1902; Magnus-Levy, Organotherapie und Innere Secretion, 1906; Krehl, Ueber die Störung chemischer Korrelationen im Organismus, 1907; Anton, Entwicklungsstörungen beim Kinde, Berlin, 1908.

[43] Lehrbuch, second edition.

[44] Grancher's Traité des maladies de l'enfance, tome iv.

[45] Ueber Hemmungslähmungen im frühen Kindesalter, Deutsch. Zeit. f. Nervenh., 1900, Band xviii, S. 167.

[46] Klinische Beobachtungen über die Muskulatur der Rachitischen, Jahrb. f. Kinderheil., 1904, lx, Heft 3.

[47] Loc. cit.

atrophy in these cases not easily noticed because of the frequent adiposis present. Whether such fully developed condition of rickets can be present at birth is highly questionable, and has up to recently been the cause of much controversy. Escher,[48] who undertook the microscopic examination of sections from a large number of apparently rachitic newborn infants, could at no time find any changes which would substantiate the diagnosis of rickets. Heubner[49] holds that one will rarely if ever be able to make the diagnosis of congenital rickets if one believes with Pommer (with whom he likewise agrees) that a retarded bone development, a standing still in the half-completed stage, is the cardinal feature in rickets. And Stoeltzner[50] says that no unchallengeable case of congenital rickets has yet been recorded. Most conclusive, however, has been that painstaking study of nearly a thousand newborn infants by E. Wieland,[51] of Basel, undertaken, as he tells us, to prove the positive side of this question, but which led to an absolute negation. He shows how former mistakes were made in judging the costocartilage nodes (Kantenbildung) so often met with in the newborn, to be rachitic ("rosary"). These are normal occurrences, especially pronounced in strong muscular babies (so also Feyerabend, Cohn, Spietschka, Escher, and Tschistowitsch). Another symptom which led astray was the so-called "craniotabes." This symptom he found present in 18 per cent. of his material (that is, in 182 of the 1000 cases), a number of these also showing bone defects, the infants being otherwise absolutely normal and not developing any signs of rickets (these cases being followed up from one to two years). He believes that the condition of "soft skull" is a "pathology" sui generis, occurring in weak children, and having no connection with rickets. Wieland's analysis leads us to conclude that rickets cannot be clinically demonstrated in the newborn, and that in all probability not the disease itself but only the disposition to it may be congenital. We may therefore say that in the majority of cases of myatonia congenita the condition is noticed within the first few days or weeks post partum, this never occurring in rickets. In most of the cases of rachitic pseudoparalysis observed by Vierordt[52] the children had already learned to stand or walk, only again to "unlearn" it. The rachitic child does not make attempts at walking, but, contrary to the normal infant, draws up its legs and usually shows resentment (irritability) to passive motion. In myatonia no rickety symptoms have thus far been reported. And finally, this fact of interest may be noted,

[48] Escher, Zur Frage der angeborenen Rachitis, Jahrbuch f. Kinderheil., Band lvi, S. 613.
[49] Lehrbuch, Band i, S. 667, 668.
[50] Handbuch d. Kinderheil. ot Pfaundler u. Schlossmann, Band i, 605.
[51] Klinische Untersuchungen über Frührachitis, Deut. med. Woch., September 3, No. 36, 1545.
[52] Loc. cit.

that the study of rickets undertaken in Hagenback's clinic at Basel showed that the tendon reflexes in this disease are never absent, but even exaggerated at times, while in myatonia congenita they are always absent.[53]

But little need be said concerning the "inhibition paralyses" ("Hemmungslähmungen") of Vierordt.[54] These are pseudo-paralyses due to pain, occurring in Barlow's disease, in hereditary syphilis (Parrot's disease), and also in rickets, as already described. As they are due to pain, the very examination will call forth muscular spasm (Oppenheim). Besides, it has been pointed out that syphilitic pseudoparalysis very rarely affects the lower extremities.[55] The history of these cases would also show that the paralysis did not date from birth (only one congenital case has been reported[56]), and that symptoms of syphilis are present, or were so a few weeks previously.[57] Infantile scurvy would also give its symptoms (swollen gums, tendency to hemorrhage, etc.), and the history would probably point to error in diet. Only once, to my mind, has a painless pseudoparalysis due to scurvy been mentioned.[58] The disease is never congenital. In myatonia congenita no symptoms of scurvy or syphilis have been noticed, no pain seems to have been present, and the affliction has been preëminently in the lower extremities.

As to polyneuritis, only that due to diphtheria could come into question, and in fact only the nasal type, in which the diphtheria might be overlooked and the history give no account of it. Then, too, diphtheritic polyneuritis within the first two years of infancy is a rarity. The muscles here affected would give the reaction of degeneration.

Paralysis due to poliomyelitis, even if not congenital, has been seen to occur early (one case of Duchenne on the twelfth day, one of Zappert on the fifteenth, one of Sinkler in the sixth week), though such early cases are extremely rare. It is easily differentiated from myatonia by the atrophy and trophic disturbance, the reaction of degeneration, the course of the disease, and in the fact that poliomyelitic paralysis occurs after an acute illness in a previously healthy child. This disease is rarely symmetrical, myatonia congenita probably always; and finally, infantile spinal paralysis improves rapidly, only a (small) part of the original paralytic

[53] The knee-jerk was reported present in Thomson's case, though nothing is said of its character. This case is not entirely unchallengeable.

[54] Loc. cit.

[55] Hutchinson, Lectures on Diseases of Children, London, 1906.

[56] Vicarelli, Revue Mens., Mars, 1892.

[57] This was noticed in a case of Oberwarth (Zur Kenntnis der syphilitischen pseudo-paralysis, Jahrbuch f. Kinderh., 1899, Band xlix). It is also interesting to note that in a few cases of this series no swelling could be felt in the involved limbs, and in four cases there was no pain on pressure or passive motion.

[58] Vierordt, loc. cit.

involvement remaining permanent—the improvement in myatonia being very slow, and general, not in any single limb.

We may exclude the possibility of a spinal hemorrhage (hematomyelia) entirely, as there are no sensory disturbances, nor affection of the bladder and rectum, nor decubitus. Nor is there anything in the etiology to suggest it (forceps, difficult labor, convulsions, scurvy, infectious disease). Should, however, the possibility of spontaneous hemorrhage in uteri be admitted (such hemorrhages occur in the adult), and we surmise that such hemorrhage has occurred in the anterior horns alone, antepartum, we would expect to find a degenerative paralysis present—in other words, the picture of congenital anteriopoliomyelitis—which, as we have already concluded, does not appear ever to have been seen.

We finally come to the consideration of two conditions which have been associated by one or two writers on this subject with our congenital hypotonic pseudoparalysis, and which, in view of Baudouin's pathological findings, are especially interesting in this connection. The first is a motornuclei aplasia, and the second is the spinal type of muscular atrophy, with which we may also consider the muscular dystrophies.

There is a pathological condition which manifests itself through paresis or paralysis of the muscles of the eyeball (ophthalmoplegia), through atrophy of the tongue, through inadequacy of facial mimic, etc. Sometimes all these symptoms are present, sometimes only one or two, as ophthalmoplegia or ptosis alone. These symptoms correspond to a lesion in the nuclei of the oculomotor, facial, hypoglossal, etc., and were thought by Möbius[59] to be due to an absence or partial development of the bulbar motor nuclei ("Infantiler Kernschwund"). Heubner,[60] in an autopsied case, was able to prove the correctness of this surmise (though it appears that some of these cases may be due to a congenital lesion anywhere along the tract between the motor nuclei and the muscle[61]). That a similar aplasia or hypoplasia of the anterior horn cells in the lumbar or cervical segments might occur does not seem impossible, but no such case substantiated by autopsy or case even suggesting such occurrence have I been able to find in the literature,[62] and the autopsies of Spiller showed no trace of spinal involvement, while that of Baudouin showed that much else apart from the anterior horn cells was pathologically affected. Muggia thought that some type of spinal

[59] Münch. med. Woch., 1892.

[60] Berlin. klin. Woch., 1890. See also Lehrbuch, ii, 124, 125.

[61] Kunn, Beit. z. Augenheilkunde, Nos. 35 and 37 (cited by Zappert). See also Oppenheim, Lehrbuch, p. 1033.

[62] Heubner (Lehrbuch, ii, 124) speaks of being able at times to find a muscle wanting in other parts of the body having nothing to do with the bulbar nuclei (as the pectoralis major). The pectoralis as an isolated congenital defect, however, appears not to be uncommon. The literature has over a hundred cases. The combination with other muscle defects is rare. See especially Ziehen, Beziehungen zwichen angeborenen Muskaldefekten, infantilen Kernschwund, etc., Berl. klin. Woch., No. 34, August 24, 1908.

aplasia might be the underlying cause in his case, though this was only a clinical observation. Just what he meant is not certain, though Rosenberg points out, that should he have implied an inhibition to ganglion cell growth ("Entwicklungshemmung") then this idea would be in keeping with Oppenheim's theory.

Of the dystrophies, we may say that the various types are usually (though not always) hereditary or familial—myatonia congenita being in but one instance familial[63] (Sorgente's two cases)—they are never congenital, they usually evidence severe atrophy, and generally affect the pelvic and lumbar musculature first, while the infantile type is earliest noticed in the face. Such distribution is not found in Oppenheim's disease. Electrically both conditions are not to be distinguished from each other, and in both a pseudo-hypotrophic form may occur because of adiposis, yet never has myatonia congenita resembled the typical picture of muscular dystrophy. Never has a case of muscular dystrophy improved as several myatonia cases have, nor have the patellar reflexes been seen to return in the former, as occasionally reported in the latter. Finally, and this is of greatest importance, the dystrophies are eminently progressive.

Much the same may be said of "early infantile spinal progressive muscle atrophy" (Werdnig and Hoffmann). This very uncommon disease (only about thirty cases have thus far been described) is exquisitely familial and hereditary (in one family six of fifteen children, in another three of six were affected; in one family in which three children were affected, eight brothers and sisters of the mother had died of the same disease). In this one fact it differs markedly from myatonia congenita, in all of which cases, with one exception (Sorgente's two cases in one family), there was no trace of any hereditary or familial tendency. Furthermore, as the majority of our myatonia cases are absolutely congenital; the cases of Werdnig, Hoffmann, and Bruns were all prenatal, beginning usually in the second half of the first year, in a few in the second year. Again all these cases were progressive and fatal, death occurring within two to four or five years. This progression showed itself in a spreading of the paralysis (beginning in the muscles of the pelvic girdle and thighs, gradually involving those of the trunk, shoulder girdle, neck, and, finally, the hands and feet). Parallel with the paralysis goes the atrophy, which becomes excessive. In no case of Oppenheim's disease has such progression been noticed, nor an outspoken atrophy. Nor was reaction of degeneration reported, though this was partially or completely present in a number of the Werdnig and Hoffmann type of cases. From this account it will be seen that though both diseases show

[63] Because of this very fact, Collier and Wilson do not wish to count Sorgente's cases to those of myatonia congenita.

a flaccid condition, with loss of tendon reflexes, a sparing of sensory, bladder, and rectal involvement, as well as of the muscular area innervated by cranial nerves, there is decided enough difference between them to diagnosticate separate clinical entities. The question, however, arises, Are there transition stages (Uebergangsformen) between the two conditions? Wimmer thought that his case was such,[64] and assumed that this disease constituted a condition in which a congenital resistentia minor obtained, which in several cases was temporary and reparable (Oppenheim's myatonia), in others progressive and lethal (Werdnig and Hoffmann's muscle-atrophy). And Rothmann[65] also maintained that the majority of myatonia cases are due to a lesion in the ganglion cells of the anterior horns occurring in fœtal life, which may vary in severity up to complete aplasia, and that between the myatonia of Oppenheim and the muscle atrophy of Hoffmann, all grades of transition cases occur, which are not to be sharply differentiated, though one may place the abating and improving myatonia cases apart from the increasing and pernicious spinal atrophies; and finally, that it is evident that transitions occur between the congenital spinal muscle atrophy with involvement of the bulbar nuclei and Möbius' infantile nuclei aplasia. Now, these seem to be interesting assumptions, though there appears to be too little in the data up to now available to substantiate them. The severe cases of myatonia did not gradually become so; the condition was seen in full development at or very soon after birth. Even in these severe cases no reaction of degeneration was present, nor was special atrophy seen; and Spiller's autopsy revealed nothing pathological in the nervous system of a pronouncedly affected case. This argues strongly against the spinal origin of the disease. On the other hand, the pathological findings reported by Baudouin speak for an arrest in the development, while the findings in the Werdnig and Hoffmann cases showed an outspoken atrophic degeneration of the entire spinomuscular neurone and terminating muscle.[66]

Interesting, too, is Bing's surmise that behind the myatonic condition may lie an inhibition not of muscle development, but of the tracts responsible for the regulation of muscle tonus—namely, the spinocerebellar tract. These tracts, however, were found in Baudouin's case to be intact. Berti, Cattaneo, and Baudouin thought that a congenital alteration in the internal secretion, probably hypofunction of the thyroid, was the cause of this disease. The thyroid gland in Baudouin's case did show extreme sclerosis. Is this, however, a chance concomitant occur-

[64] The case was congenital, the atrophy and weakness progressive. The electrical reaction was much reduced, the galvanic tardy and with very little difference between CCC and ACC.

[65] Loc cit.

[66] Leyden-Goldscheider, Erkrankungen des Rückenmarkes, Nothnagel, Wien, 1904.

rence, is it cause, or is it effect? There is no way of telling, though there is too much, as we have already seen, against the theory of thyroid hyposecretion to consider it as cause of the condition. And I may add to what I have already said under the differential diagnosis of myxœdema—and this applies to internal hyposecretion of thymus and adrenals—that one would expect in such disturbance an affection of the entire muscular system, and not of any special group of muscles (with sparing of other groups, as the distal muscles, those of bulbar innervation, etc.), as is the case in myatonia congenita.

Upon the thought of a thymic syndrome (Smith), we can scarcely comment, as we know little or nothing about the thymus. It appears that a fibrosis of this gland is commonly associated with idiopathic infantile atrophies (Fortescue-Brickdale, Dudgeon[67]).

Very little can also be said of the microscopic muscle findings. These are not typical, but similar in large measure to those in the dystrophies and spinal atrophies. Furthermore, we know too little about fœtal and early infantile muscle conditions (there is really no literature to be found upon the subject) to determine to what extent these findings are to be considered pathological.

At the finale, therefore, we are left with our pathological problem unsolved. The few autopsy examinations which have been made lead us to believe the muscle changes to be secondary, not, however, to degenerative changes in the ganglion cells of the anterior horn, but to a retarded development of these or to a congenitally enfeebled or enervated condition—capable of developing, of improving, of regaining their "trophic virility." Whether in some cases these spinal cells are congenitally abiotrophic (the word is Gowers'), destined to degenerate and atrophy, it is as yet impossible to say. Of one thing we are, however, certain, and that is that this myatonia congenita of Oppenheim's is a new clinical entity, in its typical form a sharply defined syndrome differentiable from all the heretofore-known myopathies and spinal atrophies, constituting a congenital atonic or hypotonic, pseudoparalytic condition seen mostly in children within the first two years of infancy, associated with loss of tendon reflexes, without reaction of degeneration and atrophy, of proximal distribution, always affecting the lower yet often the upper extremities, trunk and neck beside, but not the muscles of bulbar innervation, and showing a tendency to spontaneous though slow improvement (hastened in many cases under massage and electrical treatment).

[67] Cited by Carey Coombs.

[68] Bull. de la Société de pédiatrie de Paris, Février-Mars, 1899.

[69] Lévi-Singue, L'atonie Musculaire Congénitale, Gazette des Hôpitaux, No. 15, Fevrier, 1909.

SYPHILITIC PARALYSIS OF THE TRIGEMINAL NERVE.

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The trigeminal nerve is seldom paralyzed without implication of other cranial nerves, and the suspicion is occasionally entertained that syphilis may be the cause of this paralysis. It is important to know the frequency of syphilitic disease of this nerve, especially of paralysis confined to this nerve. We have several times found bilateral degeneration of the trigeminal nerve, including the spinal root, in tabes.

Oppenheim[1] refers to a long list of authors who speak of implication of the trigeminal nerve in cerebral syphilis, but apparently he is referring chiefly to the clinical manifestations, although he mentions that he has had confirmatory pathological findings. In one of his cases the spinal root of this nerve was affected, as it was also in a case reported by Brasch, and in one reported by F. Pick. According to Uhthoff's statistics, the trigeminal nerve seems to be implicated in syphilis as often as the abducent nerve, that is, in 14 per cent. of all cases of cerebral syphilis. Usually the implication of this nerve is unilateral, although exceptions to this rule occur (Leudet and Labarrière, Hutchinson). The sensory branch is much more frequently affected than the motor. Pronounced paralysis of the muscles of mastication with atrophy has occurred very exceptionally (v. Ziemssen, Loewenfeld, Oppenheim).

Nonne[2] states that Huguenin found gumma of the Gasserian ganglion; Balfour, gumma of the sella turcica, with pressure on the trigeminal nerve; and Uhthoff, in 37 necropsies in which the trigeminal nerve was found diseased, observed involvement of this nerve alone only in four. Degeneration of the spinal root of the trigeminal nerve in cerebral syphilis he states has been observed by Oppenheim, F. Pick, Brasch, and Cassirer. In all these cases the involvement of the nerve was unilateral. In Pick's case the trigeminal nerve was implicated in a gumma, in Cassirer's the cause was

[1] Oppenheim. Nothnagel's System of Medicine.
[2] Syphilis und Nervensystem, second edition, p. 233.

intense basal meningitis, in Oppenheim's and in Pick's the Gasserian ganglion was diseased.

Recently one of us (Spiller) has seen a case of cerebral syphilis in consultation with Dr. S. R. Crothers, in which left hemiparesis was associated with partial palsy of the third nerves and weakness of the motor branch of the right trigeminal nerve. The sensory branch of the trigeminal nerve was not affected. When hemiplegia from syphilis is associated with paralysis of cranial nerves, two lesions usually are found as the causes of the symptoms: a basal syphilitic meningitis producing the cranial nerve palsies, and arteritis producing occlusion of a bloodvessel with softening in the region of the internal capsule.

Five years ago a case of syphilitic disease of the fifth nerve was studied clinically by one of us (Spiller) and later the microscopic examination was conducted by us conjointly. The extraordinary fibrillary tremors of the right masseter muscle indicated that this muscle was in a condition of acute degeneration. So far as could be determined from the history and the examination, the only cranial nerve affected was the fifth on the right side, although the eyegrounds were not examined; and this fifth nerve palsy was associated with recent right hemiplegia implicating the right side of the face as well as the limbs. The palsy of the fifth nerve was inferred from the intense fibrillary contractions confined to the masseter muscle, as the man was too unconscious to respond to tests, and confirmation was obtained by the microscopic examination. No statement is made as to fibrillary contractions in the right temporal muscle, although they may have been present. The palsy affected the motor branch, and this is more uncommon than is implication of the sensory branch, but from the history it is probable that the sensory branch did not escape, as it is stated that he had pain on one side of the face. No gross lesion explanatory of the fifth nerve palsy was recorded in the notes taken by the pathologist (Dr. Alburger) who performed the necropsy, and it is probable, therefore, that it was caused by the intense syphilitic meningitis found by the microscope.

W. L., laboratory number 111, male, aged thirty-five years, colored, was admitted to the service of Dr. Stengel, March 2, 1904. About one year previously he had a stroke involving the left upper limb, which was partially paralyzed, and from this he never entirely recovered. He always dragged the left lower limb slightly after this attack.

He had suffered from "neuralgic" headaches, as he called them, a number of years. The pain was usually on one side of the face and head. It is presumable that it was on the right side, although it is not so stated. He seemed well four days before admission to the hospital. On the evening of February 29 he complained of headache, but seemed well the following day and went to work,

but had to stop work because of the headache; about six o'clock his friends noticed that he could not speak, although he was still able to walk about, and he ate moderately at the evening meal. He retired soon after dinner; on the following morning he was unable to get out of bed, and was unconscious; he could not answer questions, and could take neither water nor food.

Notes taken by Dr. Spiller shortly after his admission to the hospital are as follows: The patient is unconscious. When he is called by name he opens his eyes, but makes no sign of understanding what is said to him. He does not open his eyes very widely. The eyeballs are not deviated. He is able to look upward and to the left, but it is impossible to test the movements of the eyeballs carefully. He closes the eyelids firmly on each side, and seems to have a little flattening of the lower part of the right side of the face.

When he is told to show his teeth he attempts to do so, and the lower part of the face is moved only on the left side. He has, therefore, paralysis of the lower part of the right side of the face, but it is impossible to get him to show the tongue. The right side of the face does not contract when it is stuck with a pin, but marked contraction occurs on the left side of the face. Very intense fibrillary contractions occur continually in the right masseter muscle. The contraction of the masseter muscles cannot be tested, as it is impossible to get the man to make chewing movements.

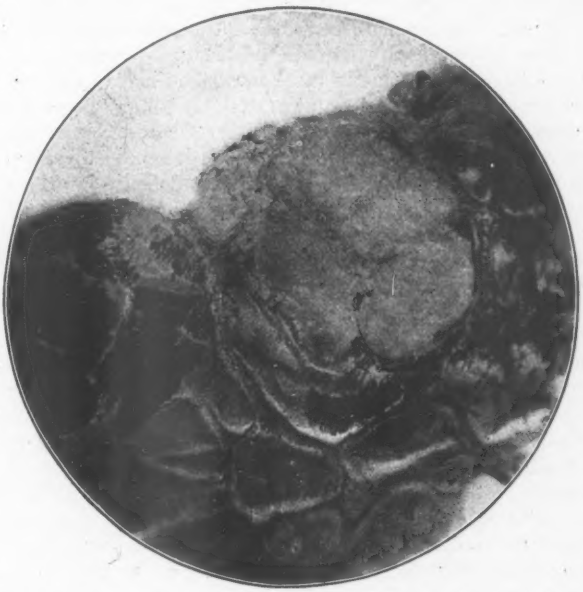
Upper limbs: He raises the left upper limb freely above the head. The right upper limb is in slightly increased tonicity. The biceps-tendon and triceps-tendon jerks and wrist reflexes are exaggerated on the right side. The corresponding reflexes on the left side are about normal. When the right upper limb is stuck with a pin very little attempt is made to move it, but he tries unsuccessfully to find the source of irritation with the left hand. Sensation for pain is probably preserved in each upper limb. The left upper limb is somewhat spastic.

Lower Limbs: The right lower limb is paralyzed. He can flex the right thigh slightly when the limb is stuck with a pin, and can flex the right knee slightly. The left lower limb is moved freely. The pinprick is perceived well in each lower limb. The right patellar reflex is exaggerated; the left is about normal. The Achilles jerk seems to be about normal on each side. A slight indication of ankle clonus is obtained on the right side. Babinski's reflex is not obtained on the right side, the toes not being moved at all. It is obtained on the left side, all the toes except the big toe being distinctly moved upward. The right lower limb is somewhat spastic, the left is about normal.

The man died shortly after admission to the hospital.

An area of softening was found in the left temporal lobe. Sections stained with the hemalum and acid fuchsin showed an intense

round-cell infiltration and numerous fatty granular cells in this region. This lesion was probably the cause of the right hemiplegia. Slight degeneration was found in the left anterior pyramid and marked degeneration in the right anterior pyramid by the Marchi stain. Probably sufficient time before death had not elapsed for intense degeneration of the left anterior pyramid, detectable by the osmic acid, to occur.



Section of the roots of the right trigeminal nerve, showing an area almost completely degenerated (Weigert stain.)

Sections of the roots of the right fifth nerve showed much degeneration when stained by the Weigert method or by acid fuchsin with hemalum, and in some parts of the sections the nerve fibers had entirely disappeared. Recent degeneration was revealed by the Marchi method in the right fifth nerve within the pons and within the spinal root of this nerve. The pia over the pons, optic chiasm, and optic nerves presented intense round-cell infiltration. The left crossed pyramidal tract was more degenerated than the right.

We are indebted to Dr. Allan J. Smith for the photograph.

THE PATHOLOGY OF THE CRANIAL NERVES IN TABES DORSALIS.[1]

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Symptoms referable to the oculomotor and especially to the abducens nerves are very frequent and often precocious in tabes dorsalis, and it is strange that the anatomical changes underlying these have so long escaped detection. The transitoriness of many cases of diplopia occurring in tabes has been believed to account for this, but this argument is invalid in cases in which the strabismus is permanent, and such cases are not infrequent. The cause of the Argyll-Robertson pupil has been a constant puzzle to neurologists, and it still remains so, as we are not yet sufficiently informed of the course of the fibers subserving the reaction of the pupil to light. This paper will not solve that riddle, although the facts herein presented may afford a substratum for future research concerning iridoplegia in tabes. Regarding oculomotor paralysis, at least, the facts here presented demonstrate the morbid anatomy and appear to solve the pathogenesis. Read in conjunction with preceding articles,[2] they very fully show the etiology, mode of genesis, and microscopic appearances of the cranial nerve palsies occurring in tabetics and paretics, both at their inception and after the disability has become permanent. The facts add one more stone to the edifice of the luetic origin of taboparesis, and afford another illustration of the explanation offered by Nageotte[3] as to the pathogenesis of those disorders.

The Initial Lesion of Tabes. It will be remembered that as long ago as 1894[4] the French neurologist presented preparations showing that the initial lesion of tabes dorsalis consists of a chronic inflammation of the posterior and often the anterior spinal roots—a transverse radiculitis. He showed that the seat of election of this process is the situation where the anterior and posterior spinal roots, in approaching one another, are surrounded by the funnel-shaped prolongation of the meninges which cover them before being

[1] Through the kindness and courtesy of Dr. Clovis Vincent, of Paris, I have been enabled in this article and in a preceding one (*New York Medical Record*, January 29, 1910) to place before American readers the main data of the two sets of investigations which Dr. Vincent has been pursuing during the last five years in the clinics of the Parisian hospitals, La Pitié, La Salpêtrière, and St. Louis, and in the laboratories of Babinski and Nageotte, Raymond, and Chauffard. The reader will see that the results of Dr. Vincent's researches afford still further corroboration of the ideas so long upheld by Babinski and Nageotte, that all the symptoms of taboparesis ensue upon a chronic meningitis of syphilitic nature. The data here expounded clearly show the untenability of the dystrophic theory of taboparesis.

[2] Medical Record, January 29, 1910; Amer. Jour. Med. Sci., August, 1908.

[3] La Pathogénie du Tabes Dorsalis, Paris, 1904.

[4] La Pathogénie du Tabes Dorsalis, Paris, 1904.; Soc. Méd. des Hôp., 1894.

pierced by them at their exit from the theca vertebralis. The gradual approximation of the meninges at this spot, he believed, produced a concentration of toxic or inflammatory materials around the nerve fibers traversing what he called the radicular zone. An arachnoiditis became a perineuritis, and finally spread into an endoneuritis. It was to this process that was due the degeneration of the posterior columns of the spinal cord. Although the anterior roots participated, their power of regeneration frequently prevented permanent paralysis and muscular atrophy; but perhaps 20 per cent. of tabetics did show some muscular atrophy sooner or later.

As a preliminary to what is to follow, no more than this need be said, for Nageotte's preparations are figured and the evidence presented in some detail in a previous article;[5] and in a shortly forthcoming communication[6] the further questions are taken up regarding the recent biochemical hypotheses which Mott[7] has advanced to reconcile the syphilitic etiology of tabes with the dystrophic theory so long held by the majority of English and German neurologists.

Reflex Iridoplegia and the Sympathetic Nerve. Future research as to the pathogenesis of the Argyll-Robertson pupil, that long-standing puzzle of neurologists, may find its direction in the lines of this investigation, for it will be noted in Vincent's case that there was no examination of the sympathetic fibers in and around the cavernous sinus, for, of course, the almost complete ophthalmoplegia could itself account for the iridoplegia of this patient. But if studies of this kind fail to reveal, in cases showing the Argyll-Robertson pupil, any lesions of the third nerve and lenticular nucleus, the incrimination of the sympathetic might be probable, for Roux[8] has shown how, in the spinal region, the sympathetic fibers are very often attacked in tabetics en route from the cord to the ganglionated chain, and that they are attacked as they traverse the radicular zone of Nageotte along with the sensory or motor fibers of the cerebrospinal system.

The mechanism of the light reflex is not yet decided. It has been considered a simple sensorimotor one, and its mechanism sought for along the arc, afferent optic fibers, synapse neurone, efferent third nerve fibers, for it is abolished by destruction of any of these. But we are by no means certain that it may not be an inhibitory phenomenon due to an arrest by the stimulus of light of the dilatatory impulses of some part of the ciliospinal or other mechanism travelling by the cranial sympathetic. In that case we should interpret the light reaction as due to a withdrawal of the antagonizing tonus of the dilator iridis from the balancing tonus of sphincter iridis, whereby the latter prevails and produces pupillary contraction; but it can do so, of course, only when its fibers in the third nerve are intact

[5] Amer. Jour. Med. Sci., August, 1908; also Brit. Med. Jour., October, 1909.
[6] International Clinics, Spring, 1910.
[7] Brit. Med. Jour., 1909, i.
[8] Thèse de Paris, 1900.

and when an afferent stimulus is possible. But if at the state of rest the sphincter tonus is unopposed from paralysis of the dilator, of course contracture of the pupil remains constant, because unopposed, and naturally the dilator afflux, already removed by disease, will not be influenced by light. In other words, an Argyll-Robertson pupil would be one that does not dilate in the absence of light.

Some tabetics' pupils are fixed in dilatation, which, on the theory now promulgated, would be explained by interference with the third nerve afflux by meningitic processes, thus leaving the dilator tonus in full sway; though it is hard to explain why such pupils do not further dilate in the absence of light (if, indeed, they do not), and thus give the appearance of contracting to the stimulus of light. At all events, it is hardly likely that a meningeal inflammation so widespread as that which causes tabes could fail to implicate some of the sympathetic fibers in their course in the cranial cavity. The difficulties of the research should be obvious, but in these days of serial sections they should not be insurmountable. It is possible, too, that the sympathetic contains sphincter fibers also, for Jegorow[9] states that he found greater dilatation of the pupil after excision of the ciliary ganglion than he did after proximal cutting of the third nerve; and François-Franck,[10] too, found that cutting the ciliary nerves caused greater dilatation than did cutting the third nerve.

THE CASE. In the case now to be described,[11] a meningitis of long standing, no longer in activity, had left its traces merely in hyperplasia of the connective tissue of the nerve and partial destruction of the noble elements. The patient was a woman, aged fifty-one years, married at eighteen, with five healthy children and two miscarriages, the last in 1885, accompanied by sore throat and followed by an attack of headache, delirium, convulsions, and coma. It was most probably a meningitis, for she remained quite blind, and had frequent attacks of focal epilepsy on the left side.[12] In 1891 Gombault had found psoriasis, blindness, laryngeal trouble, and focal epilepsy, the last disappearing. On admission the nutrition was good. There was a syphilitic perforation of the palate. There was gray atrophy of the optic papillæ, with contraction of the vessels. Even light was unperceived. There was partial ptosis, especially of the left lid. Ocular convergence was impossible. Internal lateral movements could not be accomplished, nor could the raising or lowering of the globes; but the external movements could be performed. The left pupil was larger than the right. There was no reaction to light, and that on attempting convergence and distant regard was defective. The sensibility of the cornea and the reflex

[9] Arch. Schlav. de biol., Paris, 1887, tome iii, 332.
[10] Trav. du lab. de Marey, 1880, tome iv.
[11] See Vincent, Thèse de Paris, 1910.
[12] See Souques, Soc. de neurol., May, 1905.

lacrymal secretion were present. Bilateral nystagmoid movements occurred.

Thus, there was complete paralysis of all the acts governed by the third nerve, with the exception of the pupillary reaction upon accommodation, convergence, and distance. Respiration was more rapid than normal—28 per minute. It was interrupted by paroxysms, especially after excitement. During these, breathlessness and angoisse appeared, a "whooping" cough distressed her, the face reddened, and there was often abundant secretion of tears and saliva.

Phonation was rough, bitonal, nasal, and often almost inaudible. The right vocal cord was paralyzed, and the right side of the tongue was atrophied, corrugated, and showed fibrillary twitchings. There was, perhaps, a little facial asymmetry. There were no basal crises nor bulbar trouble other than the foregoing. However, it was a typical case of basal tabes as regards the cranial symptoms.

There were no tabetic symptoms in the lower limbs, but the deep reflexes were exaggerated, and the toes sometimes extended when stroking the sole. There were occasional lightning pains, but no visceral incontinences, and no other trouble of the nervous functions. Lumbar puncture showed an intense lymphocytosis. The diagnosis was clearly basilar meningitis, superior tabes.

During the two years which elapsed before her death few new symptoms appeared. The Jacksonian epilepsy reappeared. It was probably due to an area of cerebral softening found post mortem in the right hemisphere. The ocular palsies improved, although she never succeeded in convergence or holding the eye for more than an instant toward the inner canthus. The atrophy of the tongue, however, persisted.

At the *autopsy* the meninges did not appear diseased, and the cranial nerves seemed unaltered in volume, except the optic nerve, which had shrunken to about the size of a normal oculomotor. The right angular gyrus showed an old softening about the size of a quarter. Under the microscope the spinal cord revealed no degeneration of the posterior roots nor of the posterior columns, where the internal bandalette was quite intact. The anterior roots were also normal.

The optic nerve showed characteristic tabetic atrophy, not a single nerve fiber being preserved. The connective tissue presented a very severe endoneuritis and perineuritis, with arteritis of the type described by Marie and Leri,[13] and due to transverse "radiculitis" (the optic nerve is not a homologue of a spinal root); there was no lesion of the brain or eye to account for it.

Oculomotor Nerves. The lesions (Fig. 1) were nearly identical on the two sides. That of the left shows, 4 mm. after entering the

[13] Rev. neurol., 1906.

parietes of the cavernous sinus (Figs. 2 and 3), a distinct focus of transverse radicular neuritis. This is shown by the hypertrophy of the nerve (Figs. 4 and 5), but above all by the presence in its interior of vast bands of fibrous tissue, which dissociated and left only a few intact fasciculi (Figs. 6 and 7). Farther down it is not so intense, and it has disappeared 5.5 mm. after the entry of the nerve into the sinus. Thus, its length is only 1.5 mm. It corresponds to the spot just behind the place where the nerve is divided into compartments by the layer of connective tissue which accompanies its anastomotic branches.

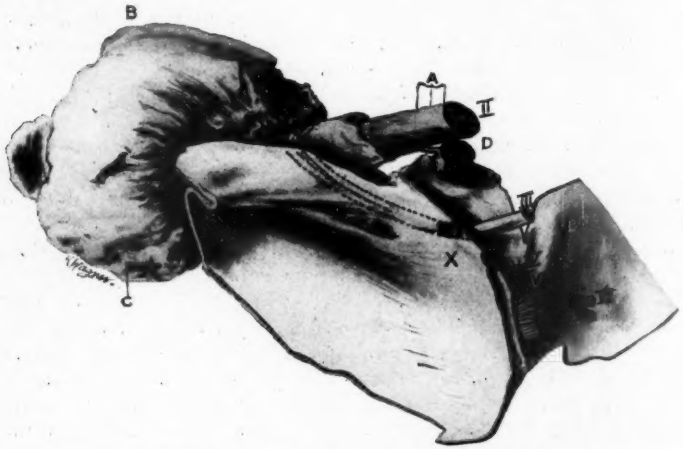

FIG. 1.—Meninges, globe of the eye, and cranial nerves removed intact to prevent tearing of the meningeal sheaths from the oculomotor nerve. The position and extent of the lesion is shown by the shaded area of the letter *X*. The subdural course of the oculomotor nerve is indicated by the dotted lines. *A*, three lines showing the direction in which the sections were made; *B*, globe of the eye; *C*, periocular fat concealing the nerves and muscles; *D*, internal carotid artery; *II*, optic nerve; *III*, oculomotor nerve; *IV*, pathetic nerve; *V*, trigeminal root; *VI*, abducens nerve.

At the parting the normal nerve becomes divided into compartments by the connective tissue, which, in a few millimeters, disappears. This is the spot where the endoneuritis has occurred. A little higher up one sees the line of the subarachnoid inflammation, now absorbed. The thickened vessel and the tucks of fibrous tissue indicate this. That the inflammatory process has not quite subsided is shown with hematein-eosin-orange stain (see original memoir). This shows that the nerve is still crammed with nuclei, and that the neighboring meninges are much altered, even obliterated, endoneuritis appearing, and that the inflammation is still present outside the sheath of the nerve, with the characteristic lymphocytes and, above all, plasma cells with the perinuclear halo. Thus it is clear

that we have over both third nerves the cicatrix of an old inflammatory focus of localized interstitial neuritis.

FIG. 2

FIG. 3

FIG. 4

FIG. 5

FIG. 2.—Transverse section (diagrammatic) of the region shown in Fig. 1, the section being made through the cavernous sinus proximal to the mark *X*. It shows the oculomotor nerve, *A*, lying in its meningeal gutter in the root of the sinus. There is at this situation no visible arachnoiditis. *B*, situation of the fourth and sixth cranial nerves; *C*, situation of the ophthalmic branch of the fifth nerve; *D*, internal carotid artery.

FIG. 3.—The third nerve. *A*, is now completely surrounded by its canal of dura and arachnoid matter, which are not yet adherent. The trabeculæ of endoneuritis are visible; other structures are as in Fig. 2.

FIG. 4.—The inflamed arachnoid is shown adhering to the third nerve at one place. The endoneuritis is still more evident than in Fig. 3. Note the increase in volume of the nerve.

FIG. 5.—The third nerve is shown transversed and disassociated by thick trabeculæ of connective tissue. Note the enormous increase in diameter of the nerve as against Figs. 2, 3, and 4, which are drawn to the same scale. The increased volume is due to the fibrinoplastic exudate and the round-cell infiltration within the sheath.

The Nerve Fibers (Figs. 8 and 9). The Weigert method shows the paleness of some of the nerve fibers among the dark violet of those remaining normal. Osmic acid shows the dwarfed and pale fibers, as in the preceding case,[14] but, above all, it reveals islands of regeneration. Both above and below the site of the lesion these islands are quite abundant, so that under low power the nerve

[14] Med. Record, January 29, 1910.

might be thought normal; but a higher power shows that the fibers they contain are often very small, squeezed together, without any connective tissue intervening. Serial sections show that they have come from a single nerve fiber, which buds out and follows an old neurilemma tract. They are significant of the presence of a noxa

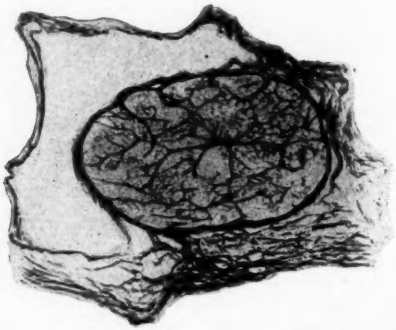

FIG. 6.—A microscopic view of Fig. 3, a transverse section of the oculomotor nerve near the commencement of the lesion. Note the endoneural trabeculæ of connective tissue and that only half the surrounding arachnoid is adherent. (Van Giesen stain.)

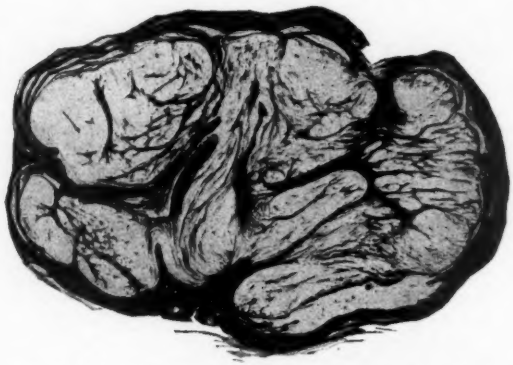

FIG. 7.—A microscopic view of Fig. 5, showing enormous neoformative endoneuritis, causing great enlargement of the nerve.

in some part of the course of the nerve, and they explain the manner in which certain tabetic palsies so much improve. In this case they are seen throughout the whole of the periphery of the nerve, especially in the fine branches penetrating the muscles, where their separation of the branches renders their study easier.

The hypoglossal nerve of this case shows changes in the nerve

fiber similar to those of a previous case,[15] and to those of the third, in that its nucleus was untouched. It is this which accounts for the absence of muscular atrophy in these cases. The nuclei of none of the cranial nerves showed any alteration, although carefully studied in serial sections; so that we may conclude that in this a focus of interstitial neuritis was the cause of the tabetic symptoms.

FIG. 9

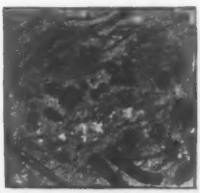

FIG. 8

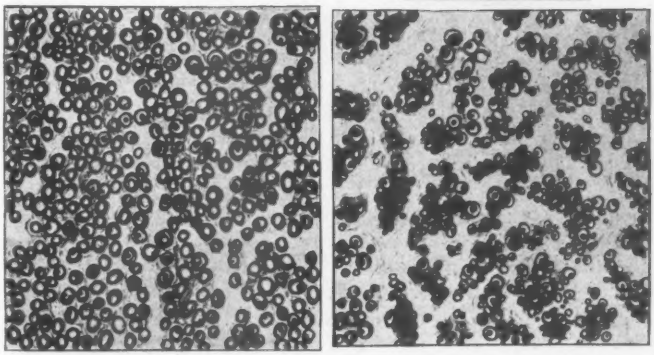

FIG. 8.—Transverse section of a normal oculomotor nerve. Note that the myelin rings and axis cylinders do not differ markedly in calibre.

FIG. 9.—The oculomotor nerve of the case studied (Azoulay method). Note the numerous atrophied fibres, small and pale, and their separation into groups by a prolilerating endoneuritis. Some regenerating fibres are seen. (Low and high power magnification.)

Although even this intense lesion had not completely destroyed the functional efficiency of the nerve fibers, except the optic ones, yet it is conceivable that such destruction may, and indeed must, occur, as is shown by the lingual hemiatrophy of this case, and the fascicular palsy and reactions of degeneration of the muscle found in tabetics in varying proportions.

PATHOLOGY OF FUGITIVE PARESIS. Now, although this case does not explain the genesis of the Argyll-Robertson pupil, it does furnish the missing link in the chain of evidence required

[15] Lot. cit.

to explain the fugitive palsies of the ocular muscles which so often occur in the course of tabes. For, though in this case the palsies were persistent, another series of facts makes it clear why they are not so in all cases. For example, Vincent[16] examined another case of tabes with only mild cranial nerve symptoms in which, unfortunately, the oculomotor nerves were spoiled at the postmortem, but in which the hypoglossal, which is also an anterior root homologue, showed the commencement of changes as a result of the progress of which the appearances in our present case ensue. Although no clinical symptoms had appeared, in spite of a considerable endoneuritis and loss of quite a large number of fibers in the hypoglossal, yet this is easily accounted for by the wide distribution among the tongue muscles of each fasciculus of the twelfth nerve, so that each part of the tongue has retained at least some muscle fibers, of which the innervation persists, to enable the tongue to perform its movements without apparent impairment.

Very different is the result when only a few nerve fibers supplying an oculomotor nerve are attacked. A very slight diminution of the innervation conveyed, for example, by the sixth nerve to the abducens muscle interferes with the delicate muscle balance needed for the adjustment of the optic axes in binocular vision. Hence the derangement is at once manifested clinically as a paralytic diplopia. The thinness of the abducens nerve makes it particularly liable to implication in the inflammatory process of the leptomeninges as it traverses its long course at the base of the brain.

Why, then, does the paralysis usually clear up in a few days, unlike the present case?

The Paresis of Secondary Syphilis. This question is answered by another series of facts, more especially conspicuous in what has been called the secondary stage of syphilitic affection. It is now known that even in this stage the meninges are inflamed quite often;[17] Buttino[18] believes in 40 per cent. of cases.

In addition to the general symptoms, such as headache, exaggerated reflexes, hyperirritability, and sometimes even Kernig's sign, quite a number of cases exhibit focal symptoms, such as facial paresis, local vasomotor changes, and neuralgias.[19] It is the rule for these to clear up along with the meningism, sometimes even without treatment. This only conforms to the tendency of the processes of lues venerea to resolve like those of other infective diseases.

The Continuity with the Tertiary Stage. It has been supposed that the tertiary lesions differ in this respect, but it is becoming evident that no distinction of kind really exists between the periods of syphilis; for, on the one hand, some cases pass

[16] Loc. cit.
[17] Ravaut, Méd.Soc. des Hôp. de Paris, 1901, etc.
[18] Riv. di Pat. Nerv. e. Ment., 1906.
[19] Drouet, Thèse de Paris, 1904.

to rapid paralysis and death within a few months,[20] while others show spontaneous recrudescence of symptoms[21] even many years after infection. Furthermore, Vincent's[22] examination of the cerebrospinal fluid of apparently healthy individuals having had syphilis has revealed, in several cases, an abundant lymphocytosis, and in some of these cases symptoms of tertiary syphilis of the nervous system showed themselves some months after his examination. It is clear, then, that between the secondary and tertiary stages of syphilis there is no absolute pathological or clinical differentium, as regards the nervous system at least; in either stage the lesions may be absorbed, and the structures involved may resume their function if they are not destroyed by the inflammation of the arachnoid, which is the fundamental lesion of tabes dorsalis.

Why Return of Functional Capacity Differs in Motor and Sensory Losses of Tabetics. As regards the fibers emanating from the spinal and cranial ganglia, a destruction is definitive, for the secondarily degenerated fibers within the central nervous system cannot reintegrate, nor are the regenerated fibers within the roots capable of utilizing the anlage of a former course; hence sensory losses of tabetics persist in spite of resolution of lesions.

The Roll of Exercises. The return of functional capacity acquired by what is known as the Fraenkel exercises is not due to the reëstablishment of old nerve paths, or the establishment of new channels of afferent information, as is so often supposed; but it is due to the patient learning volitionally to utilize the imperfect afferent information, which is all that remains to him, and to create from it a new set of automatisms to replace those which now functionate in so disorderly a fashion as to create ataxia. But when resolution occurs in the inflammatory focus surrounding peripheral efferent fibers, the functional efficiency of the diseased nerves may be resumed, even though destruction of the nerve fibers has been complete. The reason is that the degeneration of an efferent neuron attacked while traversing the meninges is entirely peripheral; and, as we know, peripheral neurons can regenerate completely and resume their accustomed path as long as there is no mechanical interruption in the course of the growing fiber. A granulomatous cicatrix sometimes furnishes this obstacle, and then the loss of function is permanent, as in the present case.

Other Causes of Neural Syphilis, not Tabetic Intoxicative. As regards the genesis in anterior radiculitis of the muscular atrophies of tabetics, some recent pathological examinations have

[20] See case of Sicard et Roussy (Rev. de neur., 1904), in which death occurred from acute meningitis seven months after the chancre, and post mortem intense subarachnoid infiltration, periarteritis, and endarteritis obliterans were found.

[21] Ballet and Barb., Rev. neur., 1908.

[22] See author's article in Med. Rec., January 29, 1910., and Vincent, loc. cit.

been used as arguments against the conceptions here presented, and in support of the dystrophic explanation of tabes dorsalis. Such, for example, are the cases of polyomyelitis antérieur chronique in syphilitics of Pierre Marie, Jr.,[23] and of S. A. K. Wilson,[24] which their authors attribute to a slow intoxication of the neurons, for, in Wilson's cases, he did not believe that the vascular changes were sufficient to account for the destruction of the anterior horn cells which he found. Læri's[25] observations on the same disease showed how often syphilis had been an antecedent; but, when it is remembered that there was a meningitis in all of Nageotte's cases, and that there was no disease of the gray matter in them, it is not difficult to see that Marie and Wilson are dealing with quite a different condition, which, though a chronic syphilitic one, may be of the same kind as the more acute and grave syphilitic intoxications revealed by the cases of Preobraschensky,[26] in which death rapidly ensued, and post mortem no scleroses nor degeneration was found, but merely atrophy of the anterior horn and roots near the cord, along with infiltration of the vessels.

The case of Crouzon and Villaret,[27] too, was believed to be intoxicative, as, after some months of meningomyelitic sciatica, an acutely ingravescent ascending paralysis caused death in eight days in a man of forty-two. Again, in an ape, which died seven months after inoculation with Treponema pallidum, having been blind and ataxic for a month, Schroeder[28] found, post mortem, no round-cell infiltration, although the myelin of the optic nerve was entirely replaced by granules, and there was intense degeneration of the posterior columns. The ape's pupils had not ceased to react to light, and the tendon jerks had been exaggerated; Schroeder did not regard it as a case of true tabes, but of an acute intoxication. The role of the syphilitic vascular diseases in producing sclerosis of the spinal cord must not be forgotten either. Tabetics are no more immune to vascular disease of the spinal cord than other syphilitics. This is only in harmony with the frequency with which tabes and aortic disease occur together, as Babinski[29] pointed out long ago.

Vascular Changes. But there is another factor in the production of the sclerosis of the cord sometimes found in tabetics in addition to the pseudosclerosed appearance of the posterior columns produced by the secondary degeneration ensuing upon radiculitis. I refer to the perivascular infiltrations in the septa, extending into the cord from the inflamed pia mater, which have been described by Bently,[30] Paviot,[31] and Schroeder.[32] The latter found them in the brain stem

[23] Rev. neurol., 1909.
[24] Review of Neurology and Psychiatry, 1909.
[25] Rev. neurol., 1907.
[26] Neurol. Centralbl., 1908.
[27] Review of Neurology and Psychiatry, 1908.
[28] Arch. f. Psych., 1908.
[29] Rev. neurol.
[30] See Beutler, Thèse de Lyon, 06.
[31] Soc. de Méd. des Hôp. de Lyon, 1905.
[32] Centralbl. f. Nervenkrankheiten u. Psychiat, 1907.

and optic nerve as well, though not in the cortex of the five cases he examined and they did not occur in alcoholic pseudotabes. It is the same trabecular infiltration which is found in the cortex of paretics (Alzheimer[33]), but in tabes it is relatively rare, even though the pia is always thickened (Spiller[34]).

I have thought it right to mention these exceptional cases, so that the main issue should not be confused by a consideration of cases complicated by lesions of which the genesis differs so markedly from those of true tabes dorsalis. In this way the uninformed will not be deceived by criticisms of the radicular genesis of tabes; for they will know that criticisms of the nature indicated are founded upon epiphenomena which may occur in any syphilitic; although they could not be adduced with regard to the case here cited, yet they might be so adduced regarding some future case in which the cranial nerve paralysis of a tabetic was due to toxemia, arteritis, or nuclear disease. This would not be a cranial nerve tabes, for that disease, like the spinal tabes itself, is always due to the transverse radiculitis of Nageotte, whether this affects the sensory or the motor roots.

ACUTE PULMONARY ŒDEMA AS A TERMINAL EVENT IN CERTAIN FORMS OF EPILEPSY.

By A. P. Ohlmacher, M.D.,
of Detroit, Michigan.

At the time the observations now to be narrated were made, that is, during the period of my active connection with the Ohio Hospital for Epileptics, from 1897 to 1905, and my then close touch with the literature of epilepsy, I could find no record to indicate that the syndrome, acute pulmonary œdema, epileptic seizures, status epilepticus, and sudden death in epileptics had been recognized. My purpose was to make it the subject of a special report, and brief mention of the matter was made in several communications[1] of that period dealing more or less fully with the question of status lymphaticus and its relation to epilepsy.[2] So far as I have been able to determine, it has received no general recognition to the present time. I wish, then, to invite attention to the subject of acute œdema of the lungs as a terminal event in certain forms of

[33] Ein Beiträg sur Histopath. d. Tabes Dorsalis, 1905, etc.

[34] Philadelphia Neurological Society, 1908.

[1] See A Consideration of the Neuroses of Status Lymphaticus, Journal of the American Medical Association, February 13, 1904; and the article Status Lymphaticus, Reference Handbook of the Medical Sciences, p. 453.

[2] See especially the Bulletin of the Ohio Hospital for Epileptics, 1898, vol. i, No. 1; 1898, vol. i, Nos. 2 and 3; 1904, vol. ii, No. 1.

epilepsy, and by the phrase "certain forms" to refer especially to that type of epilepsy in which status lymphaticus is found in morbid anatomical association.

Acute œdema of the lungs, even apart from any relation to epilepsy, is an uncommonly discussed clinical event, as one may judge from a recent excellent review by Riesman[3] who notes that little or no mention of it is made in the standard treatises on the practice of medicine. Besides carefully compiling the literature on the subject, Riesman describes the history of six personally observed cases of acute pulmonary œdema, but nowhere in his study does he mention its association with epilepsy, nor with status lymphaticus. In Geysen's thorough thesis[4] devoted to sudden death in epileptics, no allusion is made to fatal pulmonary œdema nor to status lymphaticus.

The acute serous inundation of the lungs has been observed in epileptics under several types—as accompanying a single major fit with death soon succeeding; after a single attack with coma, and death in a longer interval; after a series of fits not reaching status epilepticus; and as hastening status epilepticus to a lethal termination. There is also evidence, so far as postmortem observations go, that some of the not uncommon nocturnal fatalities among epileptics (the "found-dead-in-bed" class of institutional records) in reality are instances of acute pulmonary œdema after one or more epileptic attacks, rather than of mechanical asphyxia by bedclothing or otherwise, as is commonly believed.

To illustrate the variations just alluded to, typical cases have been selected from my notes, and will be described as concisely as possible.

Case I.—The first patient was Jenny G., who was admitted to the Ohio Hospital for Epileptics in 1896, in her nineteenth year of age. Both grand mal and petit mal had existed since her seventeenth year. There were seldom more than one or two epileptic crises during a period of twenty-four hours; but a month rarely passed without at least one major attack. She was sane, and above the average epileptic inmate in intelligence, and her general health was good.

The woman had been in her usual health April 8, 1899; that evening she was in a cheerful mood, and spent some time in the attendant's room with several other inmates. At 8 P.M. she retired, and in half an hour had a severe major epileptic attack. Frothy, reddish mucus issued from her mouth during the convulsion and reappeared as it was wiped away. A comatose condition succeeded the clonic convulsions. She was seen by the physician shortly after the fit began, and was then lying on her back; the loud, stertorous

[3] Acute Pulmonary Œdema, with Special Reference to a Recurrent Form, Amer. Jour. Med. Sci., January, 1907.

[4] De la mort inopinée ou rapide chez les epileptiques. Thèse No. 1114, Faculté de Médecine et de Pharmacie de Lyon, 1895.

breathing with occasional attempts at coughing could be heard across the large dormitory; a thin, foamy fluid escaped from the mouth and nose; at times this fluid was pinkish, and when the woman was turned on her side a gush amounting to about two ounces would follow. After several of these passive movements it was found that they only further embarrassed breathing, and she was allowed to lie on her back. There was no cessation to the appearance of the foam and the occasional gushes of fluid. The respirations during this period were sixteen to twenty a minute, and coarse rales were plainly audible at a distance from the chest. The skin was cold and clammy; the pulse of good volume and only moderately accelerated. Toward the end breathing became as short gasps, and the pulse rapid and weak. Death took place at 10 P.M., one and one-half hours after the single epileptic attack.

Autopsy. The morbid anatomical findings of chief interest relate to the lungs and the anomalies of status lymphaticus. A pronounced diffuse œdema of the lungs was indicated before the removal of these viscera by the escape of voluminous gushes of thin, frothy fluid whenever the corpse was moved, and after their removal by a very heavy, boggy, waterlogged state, the free flow of bubbly serum when they were incised, and the weight (1820 grams) of both lungs. The thymus was large, fleshy, reached the level of the second rib, the seat of numerous punctate hemorrhages, 1 cm. in thickness, weighed 30 grams, and made up of closely set adenoid follicles. There was moderate enlargement of the superficial regional lymph glands, while those of the peritoneal cavity were generally large, soft, and pinkish in hue. The solitary follicles of the stomach and intestines were prominent, and so were Peyer's patches. The spleen was large (340 grams), but its follicles were not strikingly prominent. The thyroid was soft, pale, and about one-third larger than normal. There were no other visceral morbid changes.

CASE II.—Frank S., aged twenty-two years, was a victim of grand mal and beginning epileptic dementia. He was subject to periodic major attacks of much severity. The evening of March 8, 1899, he had returned to his cottage after partaking of a hearty supper in the central dining room, seemingly in his usual general good health. While standing in the main room with some companions he was suddenly seized with a fit and fell backward, forcibly striking his head on the floor. It was noticed at once that he had not breathed properly after the convulsive phase of the attack ceased, and when the physician reached the scene he found a condition of urgent dyspnœa, with frothy fluid escaping from the mouth. The coma continued, breathing became more labored, and in twenty minutes after the epileptic attack the patient expired.

Autopsy. As disclosed by the postmortem examination, a right-sided subdural hematoma with a bulk of 50 c.c., without demon-

strable fracture of the bone or rupture of meningeal bloodvessels, had resulted from the fall. Foamy, blood-stained fluid covered the lips, cheeks, and nostrils, and when pressure was applied to the chest this fluid freely gushed from the mouth and nose. The lungs distended the pleural cavities, were boggy, and exuded bloody, frothy fluid during their manipulation, both before and after incision. A diffuse, reddish, œdematous infiltration appeared on section, the extent of which can be judged by the combined weight (2170 grams) of the freshly removed lungs. The thymus was quite large, bilobed, reddish in color, and of compact adenoid tissue; the tonsils were large, projecting so as almost to touch in the middle line. The superficial, bronchial, and mesenteric lymph glands were larger than ordinary. The spleen weighed 290 grams, and its follicles were large and prominent in the red pulp. The lymphoid follicles of the whole digestive tract were very prominent.

CASE III.—James B. was twenty-seven years old when death occurred. His grand mal began when fourteen or fifteen years of age; gradual dementia supervened, with periods of religious mania, between which the man was a quiet, mild, and tractable patient. There was no unusual preliminary to the several fits that resulted fatally. The patient had retired for the night, July 5, 1900, as well as usual. He had several epileptic seizures before midnight, but as nocturnal attacks were not uncommon with him, the night attendant felt no alarm. At about 3 A.M. he had a severe general convulsion, and his breathing was so difficult and peculiar that the attendant sent for the physician, upon whose arrival breathing became easier, though coarse rales could be heard from both lungs. The pulse was good at this moment. As the attendant and physician looked on, another hard fit occurred, with foamy fluid gushing from the mouth, and in this condition breathing quickly ceased and life was extinct.

Autopsy. Thin, frothy, blood-stained fluid escaped from the mouth whenever the body was moved. Both lungs were voluminous, adherent behind and laterally; œdematous fluid escaped from the incisions. They weighed 1050 grams. The thymus was thick, fleshy, with solid thymic adenoid follicles, and beset with hemorrhagic foci. The other features of status lymphaticus were enlarged and prominent intestinal and splenic follicles.

CASE IV.—Effie P., aged 20 years, sane; occasional grand mal; had been debilitated for some time. During the night of March 3, 1901, she had four severe fits; for the three succeeding days she acted queerly, was confused, but went to meals regularly. The next day a distinctly disturbed state set in, with constant incoherent talk, efforts to remove clothing and a generally dazed condition—epileptic mania. Sleep was induced that night by large doses of paraldehyde, and the following day a quiet, taciturn, sullen mental state developed. The patient went to her dinner and ate a moderate meal, but at 2. P.M. the fits again began, and by 7 P.M. her temper-

ature was 98°, pulse 130, respirations 42; the woman was unconscious, lips cyanotic, and gurgling rales could be heard to emphasize the labored breathing. At this hour three attacks were noted by the physician, and after each one considerable frothy fluid issued from the mouth. The gurgling continued, with frothing at the mouth; two more fits were recorded before 1.30 A.M., when death occurred.

Autopsy. The findings were essentially as have been described in the preceding cases. The lungs were free in the pleural cavity, boggy and œdematous, and weighed 1230 grams. The anatomical features of status lymphaticus corresponded to those already described.

CASE V.—Arthur A., aged twenty-five years, a victim of grand mal and epileptic dementia, began to decline. Thinking the condition due to bromism, the drug was suspended. The epileptic attacks at once became more frequent, from three to five each day. About four weeks after discontinuing the bromides, a series of grand mal began toward the morning of March 11, 1901; by 10 A.M. there had been fifteen attacks. Bromides were pushed without avail. At 11 A.M. consciousness was lost and a temperature of 102° was noted; fits occurred every fifteen to thirty minutes until 5 P.M., when death ensued in the midst of a general severe convulsion which terminated the status epilepticus. Marked dyspnœa had been noted about half an hour before the end.

Autopsy. A moderate œdema of the lungs was disclosed, together with a picture characteristic of status lymphaticus.

So much for this hurried review, in which I have endeavored, by citing the salient clinical and pathological points in five typical cases, to illustrate my thesis. In passing let it be understood that the thorough investigation at autopsy precluded the existence of renal, cardiac, or cerebral disease as explaining the causation of the pulmonary œdema; and further, that in each case a negative result followed the search for foreign bodies in the air-passages, which might have induced a mechanical suffocation.

As to the relative frequency of pulmonary œdema in epileptics, the following statistics from the records of the Ohio Hospital for Epileptics will bear witness. In the years 1903, 1904, and 1905 there were a total of 203 deaths; of these, 41 followed a single epileptic attack, or were otherwise sudden, as for example, nocturnal fatalities, in which the individual was found dead in bed. In this group of 41, œdema of the lungs was noted, either as a terminal clinical event, or was verified at autopsy in 13 cases. Again, in the period above mentioned 41 patients succumbed to status epilepticus, and among these œdema of the lungs was noted in 15 cases. That the syndrome, acute œdema of the lungs and epileptic attacks is truly a "terminal event" seems evident from the foregoing recital.

The full significance of acute pulmonary œdema in epilepsy is at most conjectural, but with what my studies have disclosed as to the

existence of status lymphaticus in these cases, we can suggestively recall the fact, repeatedly emphasized by those who have occupied themselves with that peculiar morbid condition, viz., that a tendency to sudden and usually fatal œdema—as of the larynx, lungs or brain—is one of the outstanding peculiarities of the victims of the lymphatic constitution. Accordingly, the observations here recorded should tend in two directions—to emphasize the importance of acute œdema of the lungs as a concurrence in epilepsy, and further to illustrate the kinship between certain types of epilepsy and status lymphaticus.

THE PHYSIOLOGICAL UTILIZATION OF SOME COMPLEX CARBOHYDRATES.

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It is still a current practice, especially among medical men, to look upon the proximate analysis of a food material as an adequate index of its nutritive value. In certain cases the data thus gained may be depended upon to give reliable information regarding food values; in others, however, the chemical statistics derived from the more familiar analytical procedures can become quite misleading. The explanation of this lies in the fact that much of the information furnished by the analyst is indirect in character. Protein is estimated on the basis of nitrogen content. This method may lead to erroneous conclusions in the case of plant products in particular, in which a diversity of nitrogenous constituents other than proteins are frequently present. The ether extract is designated as fats, although it is known frequently to contain lipoids, notably phosphatides, the real nutritive value of which is uncertain. The carbohydrates are not infrequently estimated by difference—a method which not only is subject to inherent error, but also fails to give any indication of the specific character of the substances represented.

An illustration of the illusory character of such analyses is afforded by the investigations of one of us upon mushrooms. These are highly prized in certain quarters because of a supposed richness in protein which is attested by a considerable content of nitrogen. Experimental studies have shown, however, that the latter is present in indigestible form, in part as nitrogenous celluloses; any representations of composition made on the basis of such analytical determinations as have just been reviewed are obviously misleading.

Turning to the most abundant nutrient group in the dietary, there are additional reasons why even an accurate identification of the carbohydrate nature of a food component is no guarantee of its nutritive value. Aside from the fact that ofttimes the individual nutrients are presented in the naturally occurring foods in a form which renders their alimentary utilization difficult on mechanical or physical grounds, numerous carbohydrates are *per se* indigestible. In the case of cellulose this has been distinctly appreciated. It has been one of the contributions of the more recent physiological investigations to emphasize, (1) the need of digestion of foodstuffs prior to their utilization, and (2) the *specific* action of enzymes in virtue of which they are selective, as it were, toward certain substrates. An illustration of these facts may be taken from the behavior of the different sugars. Cane sugar, for example, is not utilized by the organism unless it is inverted to the six-carbon sugars, dextrose and levulose. Since the alimentary tract is the only part of the body equipped to carry out this reaction, cane sugar is not readily utilized unless it is introduced enterally in the body. The specificity of the inverting enzymes is exemplified in the observations that not all disaccharide sugars are inverted, that is, digested, with equal ease by the digestive secretions; and in certain species of animals, or at definite stages of development, one or the other of the characteristic inverting enzymes may be wanting. One of us has shown this to be the case in the equipment of alimentary enzymes in the embryo as contrasted with later stages of growth. The fact that the saliva of certain animals, the dog and cat for example, is devoid of amylolytic power is likewise suggestive in this connection.

At various times attention has been directed to the introduction into wider use of a great variety of food products rich in carbohydrates, which differ especially from the more familiar types in containing in place of starches and sugars a diversity of less common carbohydrates, such as polysaccharides of galactose, mannose, pentose, methyl pentose, dextrose, etc. These are widely distributed in plants and have been heralded as suitable food preparations under varied circumstances of choice or necessity. Remembering that when a foreign carbohydrate succeeds in entering the organism proper there is no guarantee of its being retained for nutritive functions unless it has been digested and is presented in the form of a six-carbon sugar, it becomes necessary to apply the direct test of availability in the organism itself. Despite their absorption, glycogen, dextrin, starch, cane sugar, lactose, inulin, may all escape unchanged from the body unless they undergo preliminary digestion. When the actual utilization of such carbohydrates is determined by feeding trials, all the possible digestive agencies—enzymes and alimentary microörganisms—are given an opportunity to contribute toward the appropriate preparation of the food for assimilation.

The fate of a number of the carbohydrates and products containing them is already known. The starches and common sugars disappear almost completely from the alimentary tract in man, so that their "coefficient of availability" is very high. It has been shown that inulin, on the contrary, is not converted into sugar by saliva, pancreatic or intestinal extracts, although specific inulases are found in vegetable forms. Inulin can be converted into levulose by the free mineral acid of the gastric juice; and herein seems to lie its most effective opportunity for conversion to sugar in the alimentary tract. Obviously the recommendations for the dietetic use of Jerusalem artichokes or topinambur, rich in inulin, need to be subjected to experimental test. Such investigations as have been made speak against the value of these foods, despite the readiness with which they yield levulose in the laboratory. The favorable reports have emanated from observations on diabetic patients in whom ingestion of inulin has not induced any corresponding output of sugar. The error of interpretation, when the loss of the ingested carbohydrate among the undigested food residues in the feces is not taken into account, is obvious.

In another place one of us[1] has considered in greater detail some of the suggestions which have been made from time to time, and some of the current practices in regard to a diversity of unexamined carbohydrate-yielding foods. The algæ, fungi, lichens, and tree barks, as well as certain roots and tubers, are included among these. The United States Bureau of Fisheries has publicly urged that the large number of algæ "susceptible of being prepared as palatable and wholesome foods" should be given a thorough trial. Many of the genera of "sea weeds" widely used for food purposes in Japan and Hawaii are abundant on our coasts. We need only mention more familiar names, such as Iceland moss, Irish moss, dulse, laver, murlins, vegetable gelatin (agar-agar), salep, Hawaiian "limu," and Japanese "nori," to indicate the character of the materials referred to. For several years they have formed the subject of nutrition investigations in this laboratory. In the present communication the results of studies by Dr. Swartz on a series of typical products actually used in certain quarters will be reported briefly. A more detailed account with the protocols will be published elsewhere.

In one group of experiments the various products have been added to the diet of man and animals (dogs) and the utilization determined by a chemical examination of the feces. In every case, the behavior of the various carbohydrates toward enzymes (human saliva, malt and "taka" diastases, dog's pancreatic juice or pig's pancreatic extract, extracts of dog's intestines and pig's stomach), and typical bacteria (mixtures of soil and fecal bacteria, pure cultures of Bacillus coli, and other aërobes commonly occurring in the

[1] Mendel, Zentralblatt f. Stoffwechsel, 1908, No. 17; Trans. Amer. Gastro-enterological Society, 1908.

alimentary tract, and of putrefactive anaërobes) has been investigated. The fate of the constituent carbohydrates when they are introduced into dogs parenterally—with avoidance of the alimentary tract—has also been considered.

The food materials were derived largely from marine algæ, and included, besides the familiar dulse and Irish moss of our own markets, a number of species popular in the Hawaiian Islands. These were obtained through the kindness of Miss Minnie Reed, science teacher in the Kamehameha Manual Training School, Honolulu. For experimental purposes, water extracts were made whenever possible, and seaweeds which yielded no soluble carbohydrates in this way were ground in toto, and cooked before feeding. For convenience, these preparations may be grouped, according to their chief carbohydrate constituents, as follows:

Pentosans: Dulse (*Rhodymenia palmata*), and the Hawaiian algæ, limu lipoa (*Haliseris pardalis*), limu eleele (*Enteromorpha intestinalis*), limu pahapaha (*Ulva lactuca*).

Galactans: Irish moss (*Chondrus crispus*) and the Hawaiian algæ, limu manauea (*Gracilaria coronopifolia*), limu huna (*Hypnæa nidifica*), limu akiaki (*Ahnfeldtia concinna*), limu naualoli (*Gymnogongrus*), and limu kohu (*Asparagopsis sanfordiana*).

Mannan: Salep.

Levulan: Sinistrin, from the bulbs of *Scilla maritima,* known as squills.

The marine algæ named above consist chiefly of pentosans and galactans, the former being largely insoluble in water; the latter, soluble, and gelatinous in character like agar-agar.

The resistance to digestive enzymes in experiments *in vitro,* was very marked; ordinary diastatic enzymes were uniformly ineffective. With artificial gastric juice and "taka" diastase, twenty-four hours' digestion resulted in slight hydrolysis in a few instances, but control experiments with 0.2 per cent. hydrochloric acid indicated that digestion with gastric juice was due to the acid present rather than the action of any enzymes.

Bacteriological investigations showed that the carbohydrates under consideration are not readily attacked by microörganisms, but differ greatly in their ultimate powers of resistance. The galactan-containing Irish moss remained unaltered, even after a month's subjection to various species of bacteria; on the other hand, the levulan, sinistrin, and the mannan of salep were in part converted to reducing sugar by similar treatment. In the case of the soluble pentosan of dulse, no hydrolysis was observed, but decomposition gradually took place. In order of diminishing resistance to bacteria, therefore, these hemicelluloses may be said to stand thus: galactans, pentosans, levulans, mannans.

These same typical carbohydrates, introduced parenterally (subcutaneously or intraperitoneally) into dogs, were promptly

excreted through the kidneys and recovered in the urine apparently unaltered, precisely as previous experience with undigested carbohydrates would lead us to expect. In our feeding experiments the percentage of carbohydrate recovered in the feces bears a striking relation to the degree of resistance exhibited toward bacterial action, expecially in the trials with human subjects. This is hardly surprising, in view of the demonstrated inability of the digestive enzymes to hydrolyze these preparations *in vitro*, and of the animal organism to utilize them without intervention of the alimentary tract. The galactans, although administered in the form of attractive and palatable blanc mange or jellies, in moderate quantities, showed an average elimination in the feces of about 75 per cent., Irish moss proving the most completely indigestible of all preparations of this group. On the other hand, the mannan from salep and the pentosan from dulse disappeared almost completely from the human alimentary tract. Preparations in which the pentosans were of the type insoluble in water, namely, those of the three Hawaiian limu—lipoa, eleele, and pahapaha—were excreted to about 50 per cent. unchanged. The utilization was, therefore, greater than has been obtained in similar experiments in this laboratory with a substance of the dextran group, *Cetraria islandica*, of which over 75 per cent. was excreted. These results warn us against drawing sweeping conclusions as to the digestibility of hemicelluloses as a class; each type must receive special consideration. At the same time, it remains to be shown, by means of respiration experiments, to what extent those hemicelluloses which do disappear from the alimentary tract in large measure (as the mannan of salep) are a true source of energy for the organism, and to what extent they are simply decomposed by bacteria into products which play at most an insignificant part in metabolism.

It is impossible to attribute much nutritive value to the galactan extracts so highly valued as demulcents and substitutes for animal gelatin, when 75 per cent. may be promptly excreted; but they may have a useful function in the dietary of persons with a tendency to constipation, by their presence, and their power of retaining moisture, giving desirable bulk and texture to the feces. This effect has been noticeable in several experiments.

There is a further possibility that those carbohydrates which do disappear in large measure from the alimentary tract may serve as stimulants to intestinal secretory activity, and so play an important rôle. An increase in the bulk of the feces was noticeable in certain experiments in which the carbohydrate had almost entirely disappeared during its stay in the alimentary tract. Many of these modern products may deserve a place in the dietary in health or disease as food accessories. It is from this point of view, rather than because of their reputed nutrient value, that they should receive notice from the student of dietetics.

REVIEWS.

SEVEREST ANEMIAS: THEIR INFECTIVE NATURE, DIAGNOSIS, AND TREATMENT. By WILLIAM HUNTER, M.D., F.R.C.P. (Lond.), Physician and Lecturer on General Pathology and Morbid Anatomy, Charing Cross Hospital, London. Vol. I; pp. 226. London: Macmillan & Co., Ltd., 1909.

DR. HUNTER'S book on what he terms *Severest Anemias* is devoted to an exposition of his well-known and somewhat original views regarding what is commonly spoken of as pernicious anemia; the present volume is limited to an historical preface and a discussion of the etiology, nomenclature, and pathology of the disease. In brief, Dr. Hunter's opinion is that the disease is a well characterized specific infective disease of hemolytic nature localized in the alimentary tract; that in its etiology, long-standing sepsis, oral and gastric, plays an essential and important antecedant and concurrent part; anemia is but one of the symptoms, of which there are three others —glossitic and gastro-intestinal, hemolytic, and febrile and nervous —far more characteristic and due not to the anemia, but to the infective agencies underlying the disease. Disapproving of the term pernicious, he separates this so-called Addisonian (primary cryptogenetic) anemia, a specific infective disease, sharply from other types of severe or pernicious (Biermer's) anemia, which he believes may be due to other types of general sepsis; and all these types characterized as infective anemias, he differentiates from so-called non-infective anemias—that is, chlorosis and all the ordinary posthemorrhagic and other types of secondary anemia.

There is much to support the view that oral and gastro-intestinal derangement is a part, if not the cause, of pernicious anemia; and from analogy and other facts the so-called cryptogenetic form of the disease seems to be hemolytic in nature. Dr. Hunter brings to the support of his main thesis all available data, which he marshals well; but he iterates and reiterates a good deal—which neither adds to the attractiveness of the discussion, nor lends additional weight to the opinions so frequently expressed. If "pernicious" is not a good term, assuredly "severest" is not better; between "severe" and its superlative, "severest" there seems little choice; "severe" certainly does not minimize the seriousness of the diseased condition; and undoubtedly one can scarcely support the attempt

to differentiate between an Addisonian and a Biermer's anemia, this altogether aside from one's necessary disapproval of the continued use of such eponymic names. While Dr. Hunter's discussion of the anemias from the etiological and clinical standpoint has much to commend it, he misses a fine point when he minimizes the significance of a study of the morphological and other changes in the blood during life. It is perhaps worth while to mention also the fact that he regards the changes in the bone marrow as reparative, secondary to the hemolysis. The book unquestionably is a notable contribution to medicine, and a credit to the industry, patience, and persistence of the author; but it falls short of being convincing. However, we expect to read it again, and we commend it to the serious attention of the profession.

A. K.

DARWIN AND MODERN SCIENCE. Edited by A. C. SEWARD, Professor of Botany in Cambridge University. Pp. 595; 4 illustrations. Cambridge, England: University Press, 1909.

THE volume in hand is made up of a series of twenty-eight essays commemorative of the centennial anniversary of the birth of Charles Darwin and the fiftieth of the publications of the Origin of Species; and is edited by Professor Seward for the Cambridge Philosophical Society and the University of Cambridge Press Syndicate. After a tabular epitome of Darwin's life and the dates of publication of his books, the volume is introduced by a letter from Sir Joseph Dalton Hooker. The essays composing the body of the volume were suggested and the writers invited to contribute with a view of in some measure indicating the great and widespread influence, which Darwin has exerted upon civilized man; and while naturally a large proportion have been written by English scientists, and particularly by Cambridge men, there are numerous continental writers represented and two of the essays emanate from this country. All are of the highest authority and their combined publication constitutes a noble "Festschrift" in memory of the great leader of scientific thought, honorable in the highest degree to the writers and to the Cambridge originators. It is manifestly impossible in the brief space of such an article as this to note in detail or even to comment upon each of the essays; nor can the character of such a volume be regarded open to critical review. Published in commendation of a man to whom the world must always be a debtor, the Cambridge University Press has agreed to turn over to the University any profits which may possibly accrue for the purpose of endowment of biological research.

Charles Darwin was perhaps of all those competent to judge most disposed to minimize the influence of his work upon sebsequent scientific thought and methods. He marvelled at the rapid progress of science for which his own contributions furnished the greatest impetus; and it is doubtful if his modesty permitted him to recognize for his own credit even a fraction of the importance his life bore in that progress—a life which he said he had employed "in adding a little to Natural Science." But while his work dealt primarily with matters within the strict limits of biology as commonly understood, geology, psychology, ethics and sociology, modern philosophy, philology, religion, and cosmology all bear witness in this volume to the influence which his work has brought forth; and within the convential bounds of biology, the papers upon the selection theory by Weissmann, upon variation by de Vries, heredity and variation by Bateson, cellular structure and heredity by Strasburger, Haeckel's Darwin as an anthropologist, his influence upon animal embryology by Sedgwick, the paleontological record of animals by Scott of Princeton University, and that of plants by Scott of London, upon the experimental study of the influence of environment upon animals by Jacques Loeb, of the University of California, as well as others in the group, bear ample evidence. New facts and new views have grown up since Darwin's time. Darwin, in admiring comment to his friend and peer, Alfred Russell Wallace, speaks of their richness as consoling "for our efforts being overlaid and forgotten"—it is merely as the rocks of the foundation are overlaid and forgotten, but ever relied upon as the sustaining elements of the entire structure. How far this influence may reach today with its near approach to the appreciation of inheritance, its rational conception of man and his place in nature, its wider and wider application of scientific principles to human environment, its elimination of more and more of the superstitions in religion, points to a morrow of material improvement in human existence of a variable evolutional perfection of the physical man, and to a psychological realization of his relations only dimly conceived of now. Whoever may have preceded Darwin and anticipated this or that idea of Darwin's, none utilized them or placed them openly for use, as did he; and it must always be true as Osborn, of Columbia, said of him, that in science Darwin must stand as an epochal figure, before or after Darwin must be as *ante* or *post urbem conditam* was for the Roman calendar. The value of the volume for itself, both for the essays discussing the immediate work of Darwin in this or that biological field and fixing those bearing upon the more modern fruits of his influence widening out into the cognate branches, should attract a large sale; and, after Darwin's own published works, it must rank among the highest of Darwiniana. A. J. S.

SELECTED PAPERS ON HYSTERIA AND OTHER PSYCHONEUROSES. By PROFESSOR SIGMUND FREUD, Vienna. Authorized Translation by A. A. BRILL, Ph.D., M.D., Clinical Assistant in the Department of Psychiatry and Neurology in Columbia University, New York. Pp. 200. New York: The Journal of Nervous and Mental Disease Publishing Company, 1909.

THIS is the fourth of the Monograph Series edited by the *Journal of Nervous and Mental Disease*. The subject matter is divided into ten chapters, and consists, as indicated by the title, not of a continuous text on one subject, but selected papers. The editors have done their work well, and the translator, A. A. Brill, still better, for anyone who has read the original can appreciate the difficulty of translation. A word might be said here in praise of Drs. Smith Ely Jelliffe and William A. White, who are the editors of this series. So far, four of the monographs have appeared, and the reviewer, who has had the opportunity to read all, can only express his personal appreciation. The subjects which have been selected have been well considered, and all neurologists should be indebted to these gentlemen for having brought within their easy reading such difficult subjects as the psychology of dementia præcox and Freud's views on hysteria.

It is rather difficult in a short review to discuss this work, for to do so intelligently it would be necessary to re-state Freud's views of hysteria and his method of psycho-analysis, which consists in its cure. He begins by tracing the origin of so-called hysterical phenomena, and calls attention to what has already been brought out, that the hysteric suffers mostly from reminiscences. He holds that the reason that these reminiscences recur is because at the time of the original insult there was not sufficient explanation for them, and that they will recur just so long as the original condition persists. To him, just as one can, for example, cause a trauma of a nerve, just so one can cause a traumatic condition of a thought. The effectual cure of one is the cure of the other, and this is the basis of his psycho-analysis. He cites two examples at length. In these he brings out his method of analysis and effectually demonstrates that when any mental impression which has been the basis of an hysterical thought is explained, corrected, and normally associated, a recurrence of that particular thought is impossible, because there is no remaining cause of irritation. It is impossible to go farther into this matter in a short review. There are excellent chapters on psychotherapy and hysterical fancies.

At this point it might not be amiss to say a few words regarding Christian Science, mental healing, osteopathy, and similar cults. What practitioner has not had many intelligent patients go to one of these and be helped? The question arises naturally as to the cause for their apparent success and the continuance of their propa-

ganda. One reason is that the average patient who comes to a physician, whether he be a general practitioner or specialist, and complains of a symptom which is usually regarded to be neurasthenic or hysterical, is either told to forget it or that nothing is the matter with him. But, as a matter of fact, does one convince the patient, whether intelligent or stupid, that he has no pain or that his symptom does not amount to anything, when he is suffering? And again, does the average physician tell the patient how to forget it? Not at all. He goes away from the physician's office probably encouraged for the time being, but when the pain comes back he is as badly off as ever. What happens to him when he goes to an osteopath or a Christian Scientist? The first will tell him that he has a dislocation of his vertebræ or a lesion somewhere, and that he needs twenty treatments at five dollars a visit, and assures him that he can cure him, and he goes at his patient and does something for him, which to the patient means more than being told to forget, but not being shown how, or that there is nothing the matter with him. If he goes to a Christian Scientist, the "Scientist" will probably do the same thing by getting the patient's thoughts away from himself by concentrating upon Mrs, Eddy or someone else, but the effectual thing is that something is being done. It is not a matter of argument that quite a number of patients are not helped by Christian Scientists and osteopaths. The important thing is that they do something for the patient.

It should not be gathered from the above that psycho-analysis is Christian Science, or that Christian Scientists employ psycho-analysis. Far from it, for the "Scientist" simply tells the patient that he will cure him of his symptoms, but makes no attempt at psycho-analysis, and he depends entirely upon suggestion to effect his cure, whereas, by psycho-analysis an hysterical thought is removed in a reasonable, logical, and concrete manner. T. H. W.

PROGRESSIVE MEDICINE. A Quarterly Digest of Advances, Discoveries, and Improvements in the Medical and Surgical Sciences. Edited by HOBART AMORY HARE, M.D., Professor of Therapeutics and Materia Medica in the Jefferson Medical College, assisted by H. R. M. LANDIS, M.D., Demonstrator of Clinical Medicine in the Jefferson Medical College, Philadelphia. Vol. iv, pp. 334. Philadelphia and New York: Lea and Febiger, 1909.

VOLUME IV of *Progressive Medicine* for 1909 opens with an excellent discussion of recent advances in diseases of the digestive tract and allied organs, the liver, and the pancreas, by David L. Edsall. Particular attention is paid to œspohageal carcinoma,

cardiospasm, the Salomon test in diseases of the stomach, several forms of gastritis, achylia gastrica, dilatation of the stomach, gastric ulcer, gastric carcinoma, constipation, appendicitis, cirrhosis of the liver, pancreatitis, the Cammidge reaction, etc. J. Rose Bradford discusses diseases of the kidney, particularly the experimental production of nephritis, albuminuria, hematuria, the *x*-rays and renal calculi, and calculous anuria. Joseph C. Bloodgood analyzes recent advances in the surgery of the extremities, shock, anesthesia, infections, fractures, dislocations, and tumors. William T. Belfield discusses genito-urinary diseases, especially gonococcic infection (local and general), colon-bacillus infection, decapsulation of the kidney, lavage of the renal pelvis and ureter, and diseases of the prostate and the bladder. H. R. M. Landis concludes with a valuable therapeutic referendum, in which he makes special mention of adrenalin, antidiptheritic serum, antimeningitic serum, antitetanic serum, apomorphine, atoxyl, belladonna, Coley's toxins, digitalis, fresh air, iodine, lactic acid, magnesium sulphate, the nitrites, phenophthalein, pituitary extract, venesection, etc. The publication continues to merit the professional attention and approbation bestowed upon the preceding volumes. A. K.

EXPERIMENTAL RESEARCHES ON SPECIFIC THERAPEUTICS. By PAUL EHRLICH, M.D., Director of the Royal Institute for Experimental Therapy in Frankfort, Germany. Pp. 95. New York: Paul B. Hoeber, 1909.

IMMUNITY AND SPECIFIC THERAPY. By W. D'ESTE EMERY, M.D., Clinical Pathologist to King's College Hospital, London. Pp. 448; 71 illustrations. New York: Paul B. Hoeber, 1909.

EHRLICH's little book comprises a reprint of his Harben Lectures for 1907, delivered upon invitation of the Royal Institute of Public Health of London. The lectures were devoted to immunity with special reference to the relation existing between the distribution and the action of antigens, to the atreptic function, and to chemotherapeutic studies on trypanosomes. Those not familiar with the subjects must assuredly become much informed by the deductions of a master mind, of one who has established certain principles that seem to underly a rational scientific therapy.

Emery's book, as the author states, comprises an attempt to give a connected and symmetrical outline of the chief facts definitely known with regard to the method in which the body protects itself against infections, and of their applications in the diagnosis, prevention, and treatment of disease. There is a full and complete discussion of the nature of toxins, of the phemomena of antitoxin

formation, of the interrelations of toxin and antitoxin, of the origin of antitoxin, of the side-chain theory, and of immunity to toxins, as well as of such subjects as agglutinins, precipitins, phagocytosis, reactions and similar phenomena, the colloidal theory of antibodies, and immunity to bacteria. A considerable part of the book is devoted to exemplifications of the practical application of specific therapy to divers sorts of infections—all of which is exceedingly well told and amply repays the reading. A. K.

THE PRACTICE OF GYNECOLOGY. By WILLIAM EASTERLY ASHTON, M.D., LL.D., Professor of Gynecology in the Medico-Chirurgical College, Philadelphia. Fourth edition; pp. 1062; 1058 illustrations. Philadelphia and London: W. B. Saunders Company, 1909.

THE fact that this book has reached its fourth edition in as many years is a high tribute to its quality and the place it fills in the library of all interested in the field of gynecology. Compared with the previous edition, there are a few less pages of text and the same number of illustrations. Portions of a number of chapters have been rewritten and some extensively altered to give the reader the more recent views and methods of treatment in use today. Some of the most important changes made have been in the consideration of immediate versus the deferred operation in ectopic gestation, the treatment of peritonitis by the Murphy-Fowler method, the treatment of erysipelas of the vulva by the use of magnesium sulphate, the etiological factor that the modern dress, especially the modern corset, plays in the production of many of the pelvic diseases of women, and the influence of defective body form in the production of movable kidney. The book is very well illustrated throughout; the text is clear; the important parts in the text accentuated. The entire book is practical and instructive, and can be thoroughly commended to all workers in gynecology. J. A. K.

MINOR AND OPERATIVE SURGERY, INCLUDING BANDAGING. By HENRY R. WHARTON, M.D., Surgeon to the Presbyterian Hospital, Philadelphia. Seventh edition; pp. 657; 555 illustrations. Philadelphia and New York: Lea & Febiger, 1909.

A REVIEW of Wharton's work on *Minor and Operative Surgery* appears almost needless, as it is so well known to the student and

practitioner. A few changes have been made in the present edition, consisting mainly of new text on Bier's hyperemic treatment, the addition of some recent minor surgical methods, and the description of a number of new operative procedures. All parts of the book have been thoroughly revised and a number of new illustrations added. Of these, may be mentioned those illustrating the use of adhesive plaster in the treatment of leg ulcers and in strapping the foot and lower leg for sprains of the ankle, and those illustrating the use of Bier's hyperemic methods. The book is a very valuable one on the subject, especially in view of the present-day tendency to overlook everything that is not major in surgery. J. A. K.

DISEASES OF THE NOSE, THROAT, AND EAR. By WILLIAM LINCOLN BALLENGER, M.D., Professor of Otology, Rhinology, and Laryngology in the College of Physicians and Surgeons, Department of Medicine, University of Illinois. Second edition; pp. 932; 508 illustrations. Philadelphia and New York: Lea & Febiger, 1909.

THE second edition of Ballenger's book has been not only very greatly enlarged, but every page shows evidence of careful revision on the part of its author. In reviewing the first edition, a prediction was made that the book was destined to win a prominent place in the literature of diseases of the nose, throat, and ear. This prediction has been fully confirmed. In the process of revision, the different divisions of the work have been more carefully proportioned to one another, and the respective subjects of the diseases of the nose, throat, and ear are all of them now considered with a thoroughness and detail which fully justifies the author's statement in his preface, that the volume may be characterized as a "combined text-book and atlas, covering its three subjects." Dr. Ballenger's description of operative procedures are especially notable for their conciseness and lucidity, and the letter-press is accompanied by pictures which thoroughly illustrate all the details of the operation, which it is sometimes so difficult to render clear in the merely written description. Among the noteworthy additions, we would lay stress on the very excellent section devoted to an account of the functional tests of the ear. We know of no other text-book in which these recent advances in otological science are so well and thoroughly given. There is also a very good article on direct laryngoscopy and bronchoscopy. The work may be thoroughly commended as suitable for purposes not only of the student and practitioner, but also of the specialist, who desires a work of reference in which he may have access to the most recent advances in the subjects of which it treats.

F. R. P.

THE THEORY AND PRACTICE OF INFANT FEEDING, WITH NOTES ON DEVELOPMENT. By HENRY DWIGHT CHAPIN, A.M., M.D., Professor of Diseases of Children at the New York Post-Graduate School and Hospital; Attending Physician to the Post-Graduate, Willard Parker, and Riverside Hospitals. Third edition; pp. 350; 107 illustrations. New York: William Wood & Company, 1909.

A CAREFUL comparison of the third revised edition of Dr. Chapin's *Theory and Practice of Infant Feeding* with the original edition, which appeared in 1902, shows little change or modification in the text. The new edition contains some twenty-five pages more than the original, consisting largely of additions to the chapter on the milk of different animals, and the illustrations have been increased from 97 to 107.

Dr. Chapin's book stands for an authoritative exposition of the principles of top-milk feeding and the use of dextrinized cereal gruel diluents, with both of which subjects Dr. Chapin's name is identified. Cream and undermilk, or cream and whole milk mixtures, even when the cream is obtained as a definite percentage, and top-milk by the author's dipper receive little consideration, while the possibilities of whey as a diluent or as an ingredient of feeding mixtures, other than the so-called whey and cream mixtures, are dismissed with the statement that "the proteids of whey do not seem to have as much nutritive value as the proteids of the original milk from which it was made." T. S. W.

THE PRACTICE OF ANESTHETICS. By ROWLAND W. COLLUM, L.R.C.P. (Lond.), M.R.C.S. (Eng.), Anesthetist to St. Mary's Hospital, the Charing Cross Hospital, and the Hospital for Sick Children; and GENERAL SURGICAL TECHNIQUE, by H. M. W. GRAY, M.B., C.M. (Aberd.), F.R.C.S. (Edin.), Surgeon and Lecturer on Clinical Surgery, Royal Infirmary, Aberdeen. Edited by JAMES CANTLIE, M.A., M.B., C.M. (Aberd.), F.R.C.S. (Eng.), Surgeon Seamen's Hospital Society; Lecturer on Surgery in the London School of Tropical Medicine. Pp. 365; 103 illustrations. New York: William Wood & Co., 1909.

THIS volume, comprising No. 1 of a Medico-Chirurgical Series, is offered to the profession with the avowed purpose, as expressed by the editor, to present "the medical and surgical aspects of a disease, as well as the medical and surgical treatment, considered as a whole instead of in piece-meal fragments in separate volumes." Diseases requiring the coöperation of a physician and a surgeon in their pres-

entation will be treated by both in the writing of each volume. The book is divided into two portions: The first, treating of the practice of anesthetics, begins with a brief historical review of anesthesia, and then considers in detail the chemical properties and impurities of the various anesthetic compounds, the physiology of anesthesia, the preparation necessary in the administration of anesthetics, the selection of the various anesthetics, and methods of procedure in special cases and with the different anesthetics. The difficulties, dangers and their treatment, and the after-effects of the various agents are carefully detailed. This portion of the book is very thorough and instructive. The only adverse criticism that can be made is that the author practically ignores the open or drop method in the administration of ether which is extensively employed in the United States, and exception may be taken to the statement (p. 145) that, "In America, the Allis' inhaler is almost exclusively used."

In the second half of the book, treating of general surgical technique, special chapters are devoted to the preparation of the surgeon and his assistants, the care of the operating room, ligatures and sutures, bandaging, the preparation and after-treatment of patients, operations in private houses, and the common surgical operations which may have to be undertaken by the general practitioner. The book throughout is very well written, an undue amount of space is not given to unimportant details, and it can be highly recommended, not only to the general practitioner, but to the skilled anesthetist and general surgeon. J. A. K.

A Manual of Bacteriology. By Herbert U. William, M.D., Professor of Pathology and Bacteriology in the University of Buffalo. Revised by B. Meade Bolton, M.D., Bacteriologist to the Bureau of Animal Industry, Washington, D. C. Fifth edition. Pp. 466; 113 illustrations. Philadelphia: P. Blakiston's Son & Co., 1909.

In the new edition of William's well-known *Manual of Bacteriology*, Bolton has brought the book well abreast of the science as it is today. Many references, especially to the newest American literature, have been added. The subjects of diversion of the complement, trypanosomes, amœbæ, hygienic examination of milk and water, disinfection and surgical asepsis have been much changed and expanded. Here and throughout the book much important information is given in comparatively few and simple words. Dealing with the subject in a broad manner, written in clear concise English, accurate in statement, and representing the newest teaching practically along all lines of bacteriological research, the book will surely continue to be a very useful one to the student, teacher, and laboratory worker. G. C. R.

MANUAL OF MILITARY HYGIENE FOR THE MILITARY SERVICES OF THE UNITED STATES. By VALERY HARVARD, M.D., Colonel, Medical Corps, United States Army; President of the Army Medical School, Washington, D. C. Pp. 481; 235 illustrations. New York: William Wood & Company, 1909.

THIS book has been written to present the art and science of military hygiene, especially as it has been evolved in our own army during the past few years. The treatise is intended to reach other branches of military service than the medical corps alone, and for this reason it is written in a simple, somewhat elementary style, and technical terms are avoided so far as possible. The book covers a large number of subjects in its thirty-nine chapters, and so, of course, the treatment of them is in part necessarily superficial. There are, however, many interesting groups of statistics gathered from the military medical records from the United States and foreign armies. The best part of the book seems to be that dealing with the hygiene of military construction, camp regulations, and sewage disposal. This book should be of much value in disseminating a wide-spread knowledge of rational, modern hygiene among the officers of our army, without which intelligent coöperation and therefore a perfect hygiene is practically impossible.

G. C. R.

ATLAS UND GRUNDRISS DER TOPOGRAPHISCHEN UND ANGEWANDTEN ANATOMIE. By DR. MED. OSKAR SCHULTZE, Professor of Anatomy in Würzburg. Second edition; pp. 224; 22 colored plates and 205 illustrations in the text, mostly in colors. Münich: J. F. Lehmann, 1909.

THIS first volume of Lehmann's *Medical Atlases* is one of the few German works on topographical anatomy which includes any reference to applied anatomy. The appearance of a second edition six years after the publication of the first is sufficient evidence that the volume has made friends among students of anatomy and operating surgeons. In the present edition the references to applied anatomy, which in the first edition were scattered here and there in the topographical sections, have been gathered together in separate paragraphs, and are, therefore, much more useful for reference. More than 115 illustrations have been added, drawn by Herr Hajek, who, in conjunction with Herr Schmitson, supplied those used in the first edition.

The volume treats, in order, of the head, neck, upper extremity, chest, abdomen, pelvis, and lower extremity; and a sufficiently complete index is added. Under each section the various regions

(shoulder, upper arm, elbow, forearm, wrist, etc.) are discussed in order, including under each heading short paragraphs, first on the topographical anatomy, and then remarks on applied anatomy. The topographical sections are not particularly noteworthy, and those dealing with applied anatomy fall far short of the ideal. The main value of the volume lies in its excellence as an atlas. Most of the colored plates are, we believe, so far unexcelled for beauty and clearness, as well as for accuracy in anatomical detail, albeit a few errors have been noticed. For instance, in Fig. 79 the medial head of the triceps appears as the direct continuation of the coraco-brachialis; Fig. 72 has two misprints in the "leaders;" Fig. 86 has another, etc.

The illustrations are fairly divided among the various sections, so that the volume is well balanced; but the vast majority of the figures appear to have been made from the point of view of topography, the applied anatomical illustrations being conspicuous by their scarcity. There are, moreover, no adequate illustrations of the brain, joints, stomach, prostate, or perineum. The new nomenclature is adopted throughout, but the old familiar terms are occasionally added in parentheses.

A. P. C. A.

PRACTICAL DIETETICS. By W. GILMAN THOMPSON, M.D., Professor of Medicine in the Cornell University Medical College, New York. Fourth edition. Pp. 928. New York and London: D. Appleton & Co., 1909.

As the author says in his preface, the subject of foods and dietetics has made great advances since the first edition of *Practical Dietetics* in 1895. Each edition of this well-known work has been fully abreast of the subject, however, and this fourth edition is no exception. Foods and food preparations, stimulants and condiments, cooking of foods, and food digestion are all described. The relation of food to special diseases and a detailed discussion of food administration and dietetics in general, form the greater part of this excellent work. To make new comment on the book is as impossible as it would be futile, since, as some embryo author remarked after reading Shakespeare, "Nothing has been left unsaid."

E. H. G.

PROGRESS

OF

MEDICAL SCIENCE.

MEDICINE.

UNDER THE CHARGE OF

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Arteriosclerosis and Palpable Thickening of the Arterial Wall.—FISCHER and SCHLAYER (*Deut. Archiv. f. klin. Med.*, 1909, xcviii, 164) publish the results of a clinical-anatomical study, undertaken for the purpose of determining the alterations in the arterial wall which render it palpable. Their material consisted of seventy-five arteries obtained from twenty different subjects. A comparison of the palpability of the artery and its anatomical condition showed that in one half of the cases in which, anatomically, there was sclerosis of the intima, no thickening of the artery was demonstrable during life. On the contrary, in 65 per cent. of all cases there was palpable thickening, though no intimal lesion was found. Indeed, of the instances showing the most marked palpable thickening, excepting the nephritic, no sclerosis could be seen on microscopical study of the vessel wall in 75 per cent. of the cases. Therefore, they conclude, sclerosis of the intima is of minor importance in determining the palpability of a vessel. The authors found sclerosis of the media only rarely, showing that the most marked thickening of the vessel wall may be present independent of an arteriosclerosis. According to the studies of Romberg and of O. Müller, it has been established that very thick-walled arteries are to a certain extent functionally insufficient. But this thickening and impairment of function need not imply an arteriosclerosis. Microscopical examination having shown normal intima and adventitia, the cause of the thickening of the artery, in all cases in which it exists in the absence of arteriosclerosis, must be sought in the media. Thickening of the media plays a certain, though minor, role. It is apparent that the explanation of this palpable thickenmust be found principally in a functional change in the media, which

is not demonstrable anatomically. In contradistinction to the arteries in cases of contracted kidneys, these changes are coincident with diminished function, the result being practically the same as that produced by sclerosis of the arteries.

The Effect of Cardiac Stasis on the Distribution of Blood to the Internal Organs.—The general venous stasis of cardiac origin has usually been explained on purely mechanical grounds. No experimental evidence has been brought forward, and proof of other factors is therefore lacking. THACHER (*Deut. Archiv. f. klin. Med.*, 1909, xcvii, 104) has made a careful study of *acute* experimental cardiac insufficiency to determine the probable explanation of the phenomena in man. As he is careful to point out, his work does not apply to *chronic* cardiac insufficiency, which will be considered in a future paper. In rabbits, cats, and dogs, the inflation of a baloon within the right auricle is followed by immediate passive dilatation of the large veins, liver, and brain; but by a fall in the volume curves of the intestine, spleen, kidneys, and extremities. This fall in the volume curve does not coincide with the fall in the arterial pressure that follows such partial obstruction of the right auricle. The blood pressure falls within a few seconds and then remains constant or may recover slightly, whereas the volume curves continue to diminish for as much as five or six minutes longer. The lack of dependence of the volume curves upon the arterial pressure is more striking just after removal of the obstruction, when the blood pressure rises immediately; the volume curves fall temporarily and then recover gradually. In the brain and liver, organs in wihch vasomotor control is known to be extremely weak, the venous stasis following cardiac obstruction causes an acute passive congestion. In all the other organs examined, decrease in volume was noted, not merely a mechanical result of arterial anæmia, but due to an active contraction of the bloodvessels. The main factor which influences the distribution of blood to the organs is therefore not mechanical, but rather biological, that is, the vasomotor innervation of the organs. The constriction of the vessels in the spleen, kidneys, and extremities is a protective mechanism to prevent the blood pressure from reaching a dangerously low point.

The Use of Fats in the Treatment of Disorders of the Stomach.—As a result of experimental evidence which shows that the liquid fats are devoid of any excitative influence on gastric secretion, and that their presence exerts an inhibitory influence on the normal energy of the secretory process excited by other food-stuffs, a number of observers have administered liquid fats in disturbances of the stomach associated with hyperacidity. The beneficial effects of such treatment are corroborated by the series of cases reported by MOORE and FERGUSON (*Proceed. of the Royal Society of Med.*, 1909, iii, *Med. Sec.*, 25). In sixty-two cases with subjective manifestations of gastric disorder, there were given on consecutive days a plain test-breakfast, and a test breakfast preceded thirty minutes by one ounce of almond oil. In every instance the administration of oil was associated with a marked reduction in both free HCl and total acidity. The greatest reduction was found in those cases, which gave the highest average acidities with the plain

test-breakfast—cases of gastric ulcer, duodenal ulcer, and nervous dyspepsia. In twelve cases with free HCl of 50 or more, the average absolute diminution was twenty. In most instances the absolute diminution of that acidity exceeded that of free HCl. In no cases was the presence of bile-pigments or trypsin noted in the stomach contents after an oil breakfast. In simple forms of hyperacidity the addition of cream and butter in abundance to the diet, with a diminution of the starches, suffice to remove the subjective manifestations. In the more severe almond oil was administered in doses of 1 ounce in the morning, and repeated before subsequent meals if necessary.

Veronal in the Treatment of Delirium Tremens.—MOLLER (*Berl. klin. Woch.*, 1909, xlvi, 2340) reports a series of one hundred cases of delirium tremens treated with veronal. There were two deaths, one from double pneumonia, the other in a patient who had had many previous attacks and was extremely weak on admission to the hospital. Aside from these two cases, remarkably good results were obtained. Immediately after admission 1 gram of veronal is given, and if sleep is not produced by this (which is seldom the case), the same dose is repeated after an interval of three hours. As a rule, the patient goes to sleep quickly and remains asleep for six to twelve hours. On waking, he is clear, mentally, and quiet and feels perfectly well. If tremor persists, 0.5 gram of veronal is administered, and in the course of a few hours it disappears. If the patient remains under treatment for a longer time, he is given 0.5 gram of veronal each evening to insure sleep. In rare instances the delirium may not be controlled by the first 2 grams of veronal; an additional gram may then be administered five to six hours later. In one case veronal dermatitis was observed; otherwise no untoward results were noted. The author recommends that the treatment be given an extended trial.

Successful Inoculations of Chicken Leukemia.—HIRSCHFELD and JACOBY (*Ztschr. f. klin. Med.*, 1909, lxix, 107) have repeated the work of Ellermann and Bang on chicken leukemia, and, since these four authors have brought forward the first proof of the transmissibility of leukemia, it is quite possible that their studies may furnish the groundwork for the discovery of the etiology of human leukemia. Their inoculations were made from a leukemic hen furnished by Ellermann and Bang. The results obtained confirm fully those of the last named authors. Of 49 hens inoculated, 18 developed leukemia and 4 pseudoleukemia. Subcutaneous inoculations of emulsions of liver, spleen, and bone-marrow always gave negative results; the successes followed intravenous injections. The intraperitoneal route was not tried. The disease developed in from one to five months after the inoculation. The blood showed a progressive anemia, with great increase in the total number of leukocytes, mononuclear, non-granular cells predominating. Cell inclusions were at times met with. Leukemic infiltrations of the liver were very extensive, and the bone-marrow presented characteristic changes. The so-called pseudoleukemias were cases in which the typical blood picture was lacking, though the blood-forming organs showed the usual leukemic metaplasia. Unlike Ellermann and Bang,

the authors have been unsuccessful thus far with inoculations of material passed through a Berkefeld filter. Spontaneous cure has been observed in one hen, while Ellermann and Bang had a similar finding in two instances. Cultures from the organs were without result. Attempts to transfer the disease to pigeons, rabbits, and guinea-pigs have failed. The authors believe that each species has its own leukemia, since the human disease has thus far not been successfully transmitted to lower animals.

The authors have begun experiments similar to those detailed above, employing anthropoid apes, inoculated with the blood of myeloid leukemia of man. As yet, no positive results have been obtained, though it is too early to foretell the outcome of the experiments.

Some work has been done with deviation of complement in chicken leukemia, but nothing of value has been determined.

Experimental Paroxysmal Tachycardia.—Lewis (*Heart*, 1909, i, 98) gives a very complete account of the abnormalities of cardiac rhythm following ligation of the coronaries, and pays especial attention to the production of paroxysms of tachycardia with abrupt onset and cessation. In addition to the production of paroxysmal tachycardia, ligation of the descending branch of the left coronary artery may be the cause of the ventricular extrasystoles, single, successive or retrograde, while ligation of the complete right coronary artery with the subsequent anemia of both auricle and ventricle may cause auricular, "nodal," or ventricular extrasystoles, which may be isolated, frequent, and regularly placed, or in groups. Paroxysms of tachycardia were obtained in nine out of twelve dogs, in which the right coronary artery was tied, but in most instances they only set in an hour or more after the circulation was interfered with. The average ventricular rate during the paroxysms was 253, but in some attacks it was over 400. The rhythm was generally regular, and frequently each ventricular beat was followed by a contraction of the auricle at a time interval which slightly exceeded the *a-v* interval of the normally beating ventricle. The duration of the paroxysms varied from a few seconds to thirty-five minutes. The paroxysms were usually preceded by extrasystoles arising in the ventricle —after a short number of beats, retrogression to the auricle took place. When, however, the original sinus rhythm was rapid, the auricle may remain at its former rate, so that there is a complete auriculoventricular dissociation. In some instances, shortly after the onset of the paroxysm, fibrillation of the auricle occurs, apparently the result of impulses showered upon it from above and below. The fibrillation may terminate in response to sinus or to ventricle. Reversed heart block, showing most of the characteristics of the usual condition, may be met with during the paroxysms. Stimulation of the vagus during the paroxysms of tachycardia usually resulted in dropped auricular beats, without change in the ventricular rhythm, but in three instances complete, temporary standstill of the heart was obtained, followed by a return to the normal rhythm. In some cases, then, the ventricle of the dog is under control of the vagus. Alternation of the ventricles was frequent during the attacks of tachycardia. The paroxysms usually terminated by an abrupt return to the normal rhythm, but sometimes ventricular

fibrillation set in. Irregularities, almost always ventricular extrasystoles, may follow the resumption of normal rhythm. Lewis believes that paroxysmal tachycardia proper, as met with in experiment and in man, is the result of intrinsic change in the heart walls, giving rise to the production of ectopic impulses. The paroxysm has its origin in the ventricular musculature, and is constituted by the establishment of a continuous succession of what are usually designated as extrasystoles. It may be supposed that the paroxysm is the result of a local and enhanced irritability, the offspring of anemia. There is a very close analogy beteween the experimental tachycardia produced by Lewis and the ventricular form of paroxysmal tachycardia as seen in man.

The Effect of Trypsin on Cancer in Mice.—In order to determine whether trypsin has any actual effect on cancer, RUSHMORE (*Jour. Med. Research*, 1909, xxi, 591) has tested it on mice inoculated with an adenocarcinoma. In those mice in which the tumor was of moderately or very large size the injection of trypsin showed absolutely no beneficial result. In the animals with early tumors cure or spontaneous recovery resulted in 43 per cent., a figure about that which is given as the percentage for spontaneous recovery. Histological examination revealed no evidence of the trypsin having acted on the tumor cells. Those cells around the bloodvessels were in the best condition, and no especial injury to the cells lying on the periphery of the tumor, nearest the point of inoculation, could be made out.

The Bacteria of the Stools in Cancer of the Stomach.—BROWN (*Jour. Amer. Med. Assoc.*, 1909, liii, 1525) has confirmed the findings published from Neusser's clinic as to the presence of Boas-Oppler bacilli in the stools of cases of gastric carcinoma. Smears of the stools are made and stained by Gram's method. A "Gram-negative" stool excludes cancer of the stomach, while a smear showing the presence of the Gram-staining Boas-Oppler bacillus is more easily demonstrated in the stools than in the gastric contents, but it is rather readily confused with other organisms. Brown found Gram-positive stools in all cases of gastric cancer, and Gram-negative stools in both acute and chronic gastric ulcer. In four cases in which the clinical diagnosis was gastric or pyloric ulcer, but in which bacteriological examination showed Gram-positive stools, operation or autopsy revealed a carcinoma.

The Causes of Sudden Death.—BROWN (*Med. Press*, 1909, lxxxvii, 414) has analyzed 183 cases in which death occurred suddenly, before or just after the patient was admitted to the hospital. Liability to sudden death is greatest at two epochs; from birth up to three years, and from thirty years onward. From three to fourteen there is practical immunity, while from fourteen to thirty very few cases occur. Of 63 cases under five years of age, 52 occurred in the first year of life. The postmortem findings show a greater variety in children than in adults. Among the conditions met with were pulmonary collapse, suprarenal hemorrhage, and lymphatism. In more advanced life vascular degeneration is the great cause of sudden death. Of 109 cases over twenty-one years old, heart disease was the cause of death in 31

instances—10 of them being cases of aortic insufficiency. Granular kidney without other cause was found in 18 cases, atheroma of coronary artery in 17, ruptured aneurysm in 14, hemoptysis in phthisis in 9, pneumonia in 8, cerebral hemorrhage in 6, persistent thymus in 1, and in 5 cases no cause for death was found. It was striking that there was an associated granular kidney in 64.2 per cent. of the cases. Of the cardiac conditions, aortic regurgitation and coronary arteriosclerosis were the most frequent findings. When pneumonia was the cause of death, autopsy revealed in every instance gray hepatization—death being apparently due to postcritical syncope.

The Diagnostic Significance of Hemolysis in Cancer.—After an attempt to determine the practical clinical value of the hemolytic reactions in cancer and tuberculosis, SMITHIES (*Med. Rec.*, 1909, lxxvi, 901) says that while the blood serum of the majority of patients with malignant disease is capable of destroying normal red blood cells, the same manifestations are possible in non-cancerous subjects. He found the reaction positive in tuberculosis, syphilis, various forms of disease associated with anemia, in inflective processes, and in one clinically normal individual. In general, however, while the reaction is positive in the majority of cancerous patients, it is negative in the majority of normal individuals, or of persons suffering from other diseases. In so far, it may have some slight clinical value. While 85 per cent. of one hundred and fifty-three cases of cancer, in all stages, reported by Crile gave a positive hemolytic reaction, Smithies, in a much smaller series of twelve cases, obtained a positive reaction in only 58.3 per cent. In 92 per cent. of fifty-two cases of tuberculosis, Crile reports a reaction of "reverse hemolysis." This was obtained by Smithies in only two out of fifteen instances. The sera from two cases of benign tumor failed to give hemolysis.

Cardiolysis.—This operation for the treatment of cardiac insufficiency following on chronic mediastinitis or chronic adherent pericardium was suggested by Brauer, and first performed by Peterson and Simon in 1902. The twenty cases of cardiolysis which have been reported since are reviewed by LECENE (*Archiv. des. mal. du cœur, des vaisseaux, et du sang.*, 1909, ii, 673) who believes that the operation deserves to be used much more frequently. The main indication for cardiolysis is a marked systolic retraction of the precordial region apparently dependent on an adherent pericardium. The most striking results are to be sought (according to Danielson) in those cases in which the signs of cardiac insufficiency fail to clear up under the regular medical treatment. The final outcome depends on the condition of the heart muscle, and for this reason the operation should be performed early and not left as a late resort. In itself the operation is extremely simple and consists in the resection of 8 to 10 cm. of the third, fourth, and fifth ribs and cartilages—thus doing away with the rigid wall against which the heart has been tugging. The time required is about fifteen minutes. No serious results following the operation have been reported. The benefit obtained has varied in the different cases, but in general it has been quite marked, while in several instances confirmed invalids have been enabled to return to work.

SURGERY.

UNDER THE CHARGE OF

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Perforating Ulcer of the Stomach Treated and Cured by Drainage without Suture.—LEROY and MINET (*Archiv. gen. d. chir.*, 1909, iv, 1101) says that of 53 cases of perforating ulcer of the stomach, operated on by French surgeons, 38 died and 15 recovered. The case here reported had never presented digestive disturbances until five days before the sudden onset of symptoms of perforation. These consisted of slight pain on taking food, and were not relieved until vomiting occurred about a quarter or a half hour afterward. Thirty-six hours after the development of symptoms of perforation, the patient was operated on. On opening the abdomen a considerable quantity of greenish fluid containing numerous particles of food, escaped from the wound and passed to all parts of the abdomen. The chief evidence of trouble was in the region of the stomach and after considerable difficulty an opening was found in the posterior wall near the cardia and lesser curvature. It was about 5 mm. in diameter, had a punched-out appearance and was surrounded by an indurated zone. All efforts to close the opening by suture failed, and the patient's condition becoming bad, further attempts were abandoned. Four drains of large calibre were placed in the abdomen, the first under the liver, the second in the left iliac fossa, the third in Douglas' pouch, and the fourth in the lesser cavity of the peritoneum opposite the gastric perforation. The abdominal wall was then sutured. After a variable course of three months' duration, with much suppuration, the patient finally left the hospital cured.

Acetone-alcohol for the Disinfection of the Field of Operation.—HERFF (*Zentralbl. f. Chir.*, 1909, xxvi, 1777) says that acetone-alcohol is the best known disinfecting material for the skin. He disinfects the field of operation in any part as follows: No special previous preparation is made, as by sublimate applications. The part is not washed with soap and water, but the skin is rubbed for five minutes with flannel cloths wet with acetone and alcohol, equal parts. The excess is then sponged away. An alcohol or ether solution of resin was then applied with a brush as a wound protective and the sheets placed in position for the operation. After the operation the wound fluids are wiped dry, and the resin solution is applied to the sutures and the wound. Herff has previously reported concerning the clinical results. He has employed it

in over 280 abdominal sections. There were no severe wound infections. Twice there was slight infection, one from a myoma stump, the other from air infection. The bacteriological and clinical proofs have given to the acetone-alcohol and the wound protective such a high value, and the method is so simple, that it is warmly recommended.

Cystitis with Incomplete Retention of Urine.—CEALIC and STROMINGER (*Ann. d. mal. d. org. gen.-urin.*, 1909, ii, 1787) say that it is well established that inflammation of the bladder without mechanical obstruction, may produce retention of urine, complete or incomplete, the latter more frequently. Three cases of the incomplete type are reported, the cystitis being chronic. In two cases the infection was with gonococci, in the third probably with the colon bacilli. In chronic cystitis the retention is due to the pathological changes in the muscles of the bladder. In the first stage of the disease the muscle is hypertrophied by overwork. In the second stage a sclerous hypertrophy follows, and in the third stage an atrophy. Some of the muscle tissue remains, but is not well coordinated. The fatty tissue is infiltrated among the muscle fibers and disturbs the retraction of the bladder, and this leads to retention. When fluid is injected into the bladder, the desire to urinate becomes intense, while the contractility of the bladder is little accentuated. The urethral sphincter is not involved in the process, so that incontinence does not usually result. There may be incontinence due possibly to an increased sensibility or to a participation of the urethral sphincter, which plays an important part in the act of micturition. Acute retention comes on sometimes in chronic cystitis and is to be explained by attacks of acute cystitis, which produce an inhibitory action upon the bladder muscle.

Intrahuman Bone Grafting and Reimplantation of Bone.—MACEWEN (*Annals of Surgery*, 1909, l, 959) refers to a case in which the greater part of the humerus was restored by intrahuman transplantation, thirty years ago. The boy who was then operated on is now a man in regular employment, and the details of the case are presented in their entirety. Besides this case three others are mentioned, one illustrating human reimplantation of the flat bones of the skull, and two of restoration by transplantation of human jaw bones. These cases are quoted as examples of many others in which bone grafting and transplantation of bone have been successful. The periosteum plays no part in the bone reproduction after transplantation, and in the majority of the cases the periosteum was not transplanted with the bone. In the case in which the humeral shaft was largely restored thirty years ago, the grafted arm has increased in length, but not proportionately to the increase of the sound one, the latter being now three inches longer. A skiagram shows that the increase in length of the affected arm has taken place almost entirely from the proximal epiphysis. This increase may be taken as an index of the amount of growth, which usually occurs from the proximal humeral epiphysis. All but a minute portion of the distal epiphysis was destroyed by the original osteomyelitis. The grafted portion of tissue, which is easily recognized from the rest of the shaft by its form and contour, has increased markedly in thickness and somewhat in length, so that there has been here interstitial osseous increase.

This indicates that all of the increase in length of the affected shaft did not come from the epiphysis. In another case a large osseous defect in the skull, about two and one-half inches in diameter, was filled in by osseous fragments. The majority of them lived, grew, and threw out ossific matter sufficient to unite them individually to one another and to the rest of the uninjured cranium. Ten years later the skull was firm all over, the bone over the site of prior injury had grown in proportion to the rest of the skull. In a third case, the transverse ramus of the jaw, removed years before, was restored by transplantation of a piece of rib, of proper length to fill the gap. The rib was removed subperiosteally, and divided longitudinally into strips. These were inserted into the gap in the soft tissues, and secured to the ends of the bone on either side, so as to keep the right mandible in its proper position. The operation was done through an external incision below the jaw and the wound was closed over the transplanted bone and dressed. One small portion of bone was later shed. Six years after the operation the transplanted bone had thickened. The patient is now perfectly well, and can use the mouth freely for mastication; she speaks well, and the face is symmetrical.

Ligation of the Thyroid Vessels in Certain Cases of Hyperthyroidism.—MAYO (*Annals of Surgery*, 1909, l, 1018) says that the operation is indicated in those suffering from mild symptoms of hyperthyroidism, and those in whom the diagnosis is made early, possibly before the less important eye symptoms or even goitre is present. In cases, which are hardly severe enough to warrant a thyroidectomy, the ligation of the vessels will often produce a cure in a few weeks, with but little risk of special medication. It is indicated in that larger group of acute severe exophthalmic goitres, and in the chronic and very sick patients, who, having exhausted all forms of treatment, are now suffering with various secondary symptoms, dilatations and degeneration of the heart, fat liver, soft spleen, diseased kidneys, which have resulted from the toxins, as seen in the latter stage of Grave's disease, changes which are after all the final cause of death. All severe cases should be under observation for a short time at least and some cases for a considerable time, to improve their condition if possible, even before a ligation. 580 cases have been operated on at St. Mary's Hospital. Of these 225 were by ligation of the superior thyroid arteries and veins, 138 were ligated sufficiently long ago to make their report of value. There was slight improvement in 9 cases, great improvement in 44 cases, very marked improvement in 11 cases, 4 cases are absolutely well, and in 9 cases of questionable exophthalmic goitre, there was no improvement. In the majority of cases the ligation is made as a definite step in a graduated operation to reduce excessive secretion of the gland, and some of the cases are yet to be operated on for the removal of part of the gland as a secondary procedure.

Musculospiral Paralysis Complicating Fracture of the Humerus.—SCUDDER (*Annals of Surgery*, 1909, l, 1118) says that musculospiral paralysis occurs in from 4 to 8 per cent. of cases of fracture of the humerus. Fracture of the middle of the humerus is most frequently

complicated by musculospiral paralysis. It may occur at any age from fracture of the humerus. It is primary if it dates from the accident and it is secondary if it is subsequent to the accident. Primary paralysis indicates a more severe injury to the nerve than does secondary paralysis. The diagnosis of the exact pathological condition of the nerve following trauma to it, is of the greatest importance and is difficult to determine. Progressive impairment of function or stationary paralysis of the nerve, complicating fracture of the humerus justifies and may demand operation. Operation means the release of the nerve from compression or tension and often resection and suture, and always guarding against recurrent compression or stretching. A late suture (months after the injury), is attended by technical difficulties not present in an early suture (soon after the injury). Resection of the humerus to allow of approximation of the divided ends of the musculospiral nerve is a good procedure (Allis, Philadelphia), but not until nerve suture *à distance* has first been carefully employed. Electrical reactions cannot determine the pathological condition. They are of value in determining the course of events. The prognosis after operation is good; the earlier a necessary operation is done the speedier the cure. Exercise of paralyzed muscles by electric stimulation (galvanism) is helpful. Sensory symptoms are variable; in general the sensory symptoms have no relation to the degree of motor loss.

Non-operative Reduction in the Treatment of Traumatic Coxa Vara and Valga.—SPRENGEL (*Zentralb. f. Chir.*, 1909, xxxvi, 1745) takes up especially the treatment of these conditions, the anatomical and clinical aspects having been discussed in previous papers on the subject. Almost without exception it begins with a trauma, which results in an epiphyseal separation of the femoral head. The obvious treatment, therefore, is to replace the separated surfaces in position. A case is reported in which the traumatic coxa vara came to treatment three days after the accident. The displacement was so slight that the real and functional shortening was only 1 cm. The external rotation, limitation of movement, age (seventeen years), the preceding injury, and the *x*-rays made the diagnosis positive. The replacement was effected in narcosis, by forcible extreme abduction. and as far as possible internal rotation with fixation in this position by plaster-of-Paris. This position was maintained with several changes of the plaster dressing until it reached only to the knee, for four months. The result was very satisfactory. The shortening and external rotation had disappeared. Abduction and internal rotation were slightly limited and there was little disturbance of the gait. A somewhat similar case of traumatic coxa valga is also reported. A thirteen-year-old student, six weeks before admission, had stepped in a hole, and was immediately seized with a severe pain in the right hip. There was associated external rotation and a marked disturbance of the gait. Three weeks before the accident, however, there was present a slight pain in the same hip. On admission, the right femur was markedly rotated externally, slightly abducted, and somewhat flexed. There was no functional shortening, but a real shortening of 2 cm. which was overcome by a sinking of the pelvis. The *x*-rays showed a separation of the epiphysis, with a displacement in the position

of coxa valga. Reduction was performed in narcosis with forcible adduction and internal rotation. The correction was successful only when the internal rotation was carried out. It could be easily fixed in adduction and in internal rotation, which position was maintained for two months, when the treatment was changed to medical and mechanical methods. About a month later the function in both limbs was about the same. There was real shortening of 1 cm., which was overcome by sinking of the pelvis on that side. The external rotation was hardly recognizable, flexion could be made to only about one-half of the normal, rotation was the same as on the left side, and abduction to about 20 to 25 degrees was possible. There was a slight dragging of the right leg in walking. Sprengel emphasizes the importance of the use of forcible correction of the deformity as well as the prolonged immobilization afterward. Consolidation here takes place slowly, and the obliquity of the neck favors displacement of the bone ends. A correct diagnosis of the coxa vara or valga is also of great importance. He has seen about 20 cases in most of which the diagnosis of coxitis had been made.

Double Traumatic Dislocation of the Shoulder.—LINDEMANN (*Deut. Ztschr. f. Chir.*, 1909, cii, 561) saw in three months, three cases of simultaneous, traumatic dislocation of the two shoulders. He saw also two cases of simultaneous dislocation of both shoulders in persons who had previously suffered from a dislocation of one or the other shoulder; and in which there occurred a dislocation in the left shoulder, previously sound. In children dislocations of the shoulder are rare, in middle age they are not common, and only in old age are they relatively common. Only one of Lindemann's patients was young (eighteen years). The others were thirty-six, forty-seven, fifty-seven, sixty, and sixty-six years of age. It is believed that changes in the joint and ligaments and overlying soft tissues play an important role, as when they are atrophied. In the young and middle aged these structures are so strong that the bones are more frequently fractured than dislocated. The relaxation of the ligaments and other soft structures coming on with age, gradually loosens the joint. Degenerative changes also play a part, and these come on in some cases earlier than in others, especially in the working classes, among whom the dislocations most frequently occur. Severe violence is not always necessary, even for a double dislocation. They may be due to direct or indirect violence or to muscular contraction. All the dislocations observed by Lindemann were preglenoidal, three of them purely subcoracoid, in which the *x*-rays showed no changes in the bones. In one case there was a shadow, probably from a broken-off piece of bone. A tearing off of the greater tuberosity was shown in one of the cases, and on the same side a fracture of the glenoid margin. In three recent cases reduction by Kocher's method was easy, without narcosis, but with small doses of morphine. In only one of the recent cases was narcosis necessary. In one case in which the dislocation was three months old, the reduction was unsuccessful in the first attempt, and successful on the second attempt under narcosis. On the other side, in the same case, the careful efforts at reduction on account of the evident atrophy, led to a fracture of the shaft of the humerus at the deltoid

insertion. In one case there soon developed recurrent dislocations in one shoulder and later in the other. In this case altogether about two hundred dislocations occurred, and in one day as many as three. In the past four years the patient has been unable to work.

Volvulus of the Intestines as a Disease of Hungry Men.—SPASOKUKOZKY (*Archiv. f. klin. Chir.*, 1909, xclx, 211) says that he has collected observations for eleven years, in the government hospital at Smolensk. About 70 per cent. of the patients are peasants, and nearly all of them country people. This fact is of especial importance since the literature of ileus concerns itself chiefly with patients from the large cities. It is generally considered that volvulus of the sigmoid flexure is the most common, while other parts of the intestinal tract are very rarely involved. Lindemann's observations lead to a different conclusion. Of the 96 cases of acute intestinal obstruction, there were 8 of invagination, 8 of tumor (cancer, tuberculosis), 5 of properitoneal hernia, 20 of strangulated hernia, 8 of unknown cause, and 47 of intestinal volvulus. Of the 47 cases of volvulus, 18 were of the sigmoid flexure, 1 of the cecum, and 28 of the small intestine. Concerning the question of the turning of the intestine, there are three chief factors: (1) The intestinal peristalsis which is permanent and is increased by the taking of food and the work of the intestine. (2) The intestinal contents; moderate filling of the intestine occurs with a meat diet, and excessive filling with a vegetable diet. At times the intestines are absolutely empty. Two cases were observed in which the total contents of the small intestines could be held in the hollow of the two hands. (3) Abdominal pressure; this varies between extreme limits, as between the lax abdominal wall of the multipara, and the tense abdominal wall of a strong man. In one patient who was extremely emaciated the operation showed that all the small intestines lay to the left of the sigmoid flexure, which was snared by them and was very much dilated. In considering the mechanism of this case and an analogous one, Spasokukozky is convinced that there must have been a time when the small pelvis was free of small intestines and filled by the sigmoid flexure. The small intestines, empty because of hunger, moved upward. The vomiting caused further movement upward into the left hypochondrium. By the taking of nourishment or by a change in position, the sigmoid moved out of the pelvis. The small intestines then took its place, passing over and constricting the two ends of the sigmoid.

THERAPEUTICS.

UNDER THE CHARGE OF

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The Hemoptysis of Phthisis and its Treatment.—REICHE (*Zeit. f. aerzt. Fortbildung*, 1909, xv, 465) says that the patient should be kept

in bed and avoid all physical and mental effort. Warm drinks, alchohol, and effervescent drinks should be prohibited. The food and drink of the patient should be reduced to a minimum. An ice bag on the chest corresponding to the part of the lung involved may be of service. Morphine should be prescribed to stop the cough. Reiche says that digitalis acts well in some cases, those in which the bleeding is dependent upon a congestion of the venous pulmonary system. If the arterial system is the source of hemorrhage, digitalis is unsafe. Reiche admits that the differential diagnosis of these two forms of pulmonary hemorrhage is difficult and often impossible. He believes that adrenalin is harmful and that ergot has little or no effect in pulmonary hemorrhage. He has used gelatin with no convincing results of its efficacy. The ingestion of gelatin by the mouth probably has little or no effect upon pulmonary hemorrhage. While the subcutaneous injection is painful, Reiche has seen good results with the use of calcium chloride in hemoptysis in some cases. He recommends a dose of 4 grams during the twenty-four hours, divided into two doses. The use of calcium chloride is perfectly safe, but its effect varies considerably in individual cases. Furthermore, it is always difficult to estimate a definite therapeutic effect of a drug in pulmonary hemorrhage which often ceases spontaneously.

The Treatment of Severe Anemias with Human Blood Transfusion.—WEBER (*Deut. Archiv f. klin. Med.*, 1909, i, ii, 165) reports seven cases of severe primary anemia which he treated by human blood transfusion. He obtained about 25 c.c. of blood by aspirating the median basilic vein of a healthy young man. This blood was stirred for ten minutes with a sterile glass rod in a sterile vessel and then filtered. He used this defibrinated blood as a stock solution. The maximum dose of this solution was 5 c.c. He injected this solution by means of a syringe into the median basilic vein of the patient. All of the cases received at least three transfusions during a period of six weeks or more, and they all improved. The percentage of hemoglobin and the number of red blood cells increased and at the same time the symptoms improved. Untoward effects after the transfusion were frequent, but of short duration and not serious. The most common untoward effects were moderate fever, headache, ringing in the ears, malaise, and dyspnœa. In one case transfusion was followed by fever lasting four days, with a small area of consolidation in the right lung, probably due to infarction. Weber ascribes the beneficial effects of blood transfusions to a stimulation of the blood-making cells of the bone marrow. He observed always after the injections a great increase in the number of nucleated red blood cells. Therefore, he advocates the use of only 5 c.c. of blood at each transfusion, since the beneficial effects are not due to an increase in the volume of the blood. Weber claims that his method is simple and safe, with equal or better results than with arsenic or the larger transfusions.

Camphor and Pneumococci.—SEIBERT (*Münch. med. Woch.*, 1909, xxxvi, 1834) treated a series of 21 cases of pneumonia with injections of camphor oil. The age of the youngest patient was four years, and

the oldest seventy-two years. He does not give detailed reports of his cases, nor does he state the average duration of the disease under this treatment. The camphor was administered in the form of a 20 per cent. solution in oil. He gave it in variable doses as high as 12 c.c. at a single dose. He repeated the dose every twelve hours until the pulse, respirations, and temperature became normal, and then every twenty-four hours until the lungs were clear. Seibert noted that no crisis occurred in any case, but that a gradual improvement followed immediately after the first injection and continued to recovery in every case. He also adds that the duration of the disease was considerably shortened. Seibert thinks that the effect of camphor may be explained by a direct bactericidal action upon the pneumococci, in addition to the stimulating action of the camphor. The number of Seibert's cases does not allow one to draw any definite conclusions, and furthermore, his series of cases occurred during the summer months when pneumonia is, as a rule, less virulent.

A New Method of Treatment of Epilepsy.—BRATZ and SCHLOCKOW (*Deut. med. Woch.*, 1909, xxvii, 1184) write concerning the treatment of epilepsy in the state institute for epileptics at Wuhlgarten. They treated 50 cases of epilepsy with sabromin. Sabromin is similar in structure to sajodin, being the calcium salt of dibrombehendic acid. It contains 29 per cent. of bromine; 3 grams of sabromin seems to equal 4 to 6 grams of potassium bromide in strength. They gave the sabromin in tablet form, each tablet containing 0.5 gram. It was found better to give the remedy one hour after meals. It was especially noteworthy to see the disappearance of various skin eruptions, which had been caused by other bromine preparations. Furthermore, no case of skin eruption was observed during the use of sabromin. This has been explained by the fact that less bromine is furnished to the body by sabromin. However, it seems to be a fact that sabromin, although it contains less bromine, is able to exercise the same anti-epileptic action as the other bromine salts. They state that 4 grams of sabromin contains about one-half the amount of bromine in an equal quantity of potassium bromide, though it equals 6 grams of potassium bromide in efficacy. To explain its action it has been suggested that sabromin combines directly with the nervous tissue.

A New Bromine Preparation in the Treatment of Epilepsy.—HAYMANN (*Med. Klin.*, 1908, I, 1910) gives the results obtained in the psychiatric clinic at Freiburg with the use of sabromin in the treatment of epilepsy. Some of the patients have been under the treatment for seven months, and many for from two to four months. Haymann found that the remedy was well borne, causing no untoward symptoms on the part of the gastro-intestinal tract. The patients took the remedy with ease, it being odorless and almost tasteless. No bromine acne was observed during the use of sabromin; on the other hand, already existing skin eruptions cleared up. Two tablets of 0.5 gram each, given three times a day, gave the necessary saturation of the body with bromine. This same effect, he says, would not be obtained with 4 grams of potassium

bromide. Haymann determined that the dose could be considerably increased without the danger of poisonous symptoms. It appears plausible from the chemical structure of sabromin that its action is slow, and at the same time prolonged. Haymann says that his clinical observations agree with this theory. No patient became accustomed to the remedy, so that it was not necessary to increase the dosage.

The Action of Fats in Excessive Gastric Secretion.—MARTINET (*Presse méd.*, 1909, lviii, 515) advocates the use of olive oil in cases of excessive gastric secretion, such as ulcer of the stomach, simple hyperchlorhydria, and gastrosuccorrhœa. He also believes that from 100 to 150 grams of olive oil taken before breakfast is beneficial in the treatment of gallstones. Often the olive oil is objectionable, and then the fat may be prescribed in the form of fresh milk or cream. Fresh almonds up to an amount of 80 to 100 grams a day may also be used to furnish the required amount of fat. Fresh bone marrow spread on bread in place of butter is another method suggested for supplying the fat. He also suggests that olive oil may be substituted for butter in the preparation of food, since it is more easily digestible than other fats. Olive oil, he claims, diminishes gastric secertion, regulates the bowels, and supplies easily digestible nutriment.

The Treatment of Gastric Ulcer with Iron Chloride Gelatin.—BOURGET (*Therap. Monats.*, 1909, vii, 353) has used, for a number of years, stomach lavage with a 1 per cent. solution of iron chloride for the treatment of gastric ulcer. He replies to the objections of some against the use of the stomach tube in ulcer of the stomach that he has used it thousands of times with no bad results. On the contrary, most of his cases have been cured in fourteen days, and some even in still less time. Since, in practice, it is often inconvenient to use a stomach tube, he has endeavored to apply a modification of this treatment by giving the iron chloride in gelatin. He prepares this in the following manner: 100 grams of gelatin is dissolved in 100 grams of water and 100 grams of glycerin. To this he adds 50 grams of a 10 per cent. solution of iron chloride. The addition of the iron chloride forms a precipitate. The mixture is stirred vigorously while warm in order to secure a homogeneous distribution of this precipitate. The mixture is then poured into the moulds of 1 c.c. capacity and allowed to harden. Two or three of these tablets are given two or three hours after meals. Bourget follows this routine: 8 A.M., milk and zwiebach; 10 A.M., one tablet; 10.30 A.M., 100 to 150 grams of alkaline water; 12 noon, milk and rice; 3 P.M., one tablet; 3.30 P.M. to 4, 150 grams of alkaline water; 6 P.M., milk and rice; 9 P.M., one tablet; 10 P.M., 150 grams alkaline water. The prescription for the alkaline water is as follows:

℞—Natrii bicarb. puriss.	8.0
Natrii phosph. sicci.	4.0
Natrii sulph.sicci.	2.0

The prescription is to be divided into powders.
Dissolve one of these powders in 1 liter of cold water.
The effect of this method of treatment is very favorable, especially

upon the pain. In the severe cases with bleeding he begins the treatment by lavage with a 1 per cent. iron chloride solution and then follows with the iron chloride gelatin. In all the cases so treated the bleeding stopped immediately and did not recur. Bourget adds that the iron chloride gelatin has the further advantage of combating the anemia.

The Treatment of Stokes-Adams Syndrome.—Wilcox (*Boston Med. and Surg. Jour.*, 1909, xxv, 825) recommends in the treatment of Stokes-Adams syndrome the use of atropine to diminish the irritability of the pneumogastric terminals, and strychnine to increase the force and frequency of the ventricular systole. He adds that atropine is useless when the symptoms are dependent upon a myocarditis. Alcohol in some cases has seemed to diminish the attacks. Wilcox also secured good results by the use of cactus grandiflorus given in the form of the fluid extract in doses of 30 drops. After the acute attack has subsided he gives iodide of arsenic in doses of 1 mg. three times a day. Since the presence of gummas in the bundle of His has been determined in a number of autopsies, he thinks it wise to try mercurial inunctions or intramuscular injections of iodide of mercury in oil. At the same time strontium iodide should be given in increasing doses.

PEDIATRICS.

UNDER THE CHARGE OF

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The Effect of Cathartic Drugs in Children.—I. A. Abt (*Archives Pediatrics*, 1909, xxvi, 836) reports the result of observations made to determine the therapeutic limitations of cathartic drugs in children. Calomel, castor-oil, and Epsom salts were given 125 times to 22 children. The stools were examined before administration began and also twenty-four hours afterward, particular stress being laid on the presence of blood and mucus in the feces; these elements being taken as an index of the degree of irritation produced. Calomel in 1-grain doses, and the same amount in divided doses, showed on the following day mucus, and occasionally blood in the stools. Two or 3 grains given at one dose showed both blood and mucus, which continued for two and three days. When calomel was given in daily divided doses ($\frac{1}{10}$ grain) for a consecutive number of days, the reaction for mucus and blood increased in intensity from day to day.

Magnesium sulphate in single doses of 1 dram of a saturated solution resulted in slight irritation, but no blood. Larger doses, 1 dram for three successive days, showed the reaction for blood and considerable mucus, though not as much as followed repeated doses of calomel. Castor oil in single doses of 1 dram showed no irritation. Two drams at one dose administered to older children showed irritation in one case

and none in the other. One dram of the oil for three successive nights caused the reaction of irritation after the third dose. A study of the results shows that all three cathartics are capable of producing signs of irritation if the dose is large enough or continued for a period of time. Calomel seems to give the greatest irritation with average doses, in the shortest time. Castor-oil gives the least reaction. The Weber and benzidene tests were employed to demonstrate the presence of blood. It was observed that green stools were especially frequent after calomel and that the odor was more offensive. Calomel also produced the most marked effect on oxidized bile pigment, when present. The quantity of unoxidized bile pigment was usually larger after catharsis.

Flexner and Jobling's Anti-serum in Cerebrospinal Meningitis.—PERCY MARSH and OWEN WILLIAMS (*Brit. Jour. Children's Dis.*, 1909, vi, 299) report the results of Flexner and Jobling's antiserum in 18 consecutive cases of cerebrospinal meningitis in children. The examination of cerebrospinal fluid from lumbar puncture is essential in every case of meningitis. Besides the tuberculous, the most common form was found to be due to Diplococcus meningitidis, a Gram-negative organism. For this form the antiserum is most serviceable. Flexner's statistics show a reduction of mortality in all forms of the disease of 29.6 per cent. In 523 cases tested with the serum 368 recovered. The efficacy of the serum is increased the earlier it is given. In Flexner's tables of children under two years, of eleven treated in the first three days one died; of eleven treated before the seventh day four died; whereas of 29 treated after seven days 20 died. Of the 18 cases reported by Marsh and Williams the first four were tuberculous meningitis, in which Diplococcus meningitidis was also isolated, showing that the latter may occur merely as a secondary infection to other forms. In the remaining 14 cases the diplococcus alone was isolated in every instance. Twelve of the 14 were under one year. There were 7 recoveries in the series, 5 of which were under one year. Only 3 cases were obtained in the first few days of illness and all of these recovered, two being infants of three and five months, respectively. In the other case the serum was injected from the seventh day to as late as the fifty-eighth day. In all the cases the fluid from the first puncture showed turbidity. It contained albumin in increased quantity, reduced Fehling's solution only slightly, and contained polymorphonuclear leukocytes, vacuolated cells, and the diplococcus both intra- and extra-cellular. After the first and second injection of serum the number of organisms is decidedly reduced, and after the seventh day this fluid becomes clear and free from organisms. The dosage depends on the age of the patient, the severity of the infection and the number of organisms present. Dunn, of Boston, advocates in older children and adults four doses of 30 c.c. each, on successive days. Smaller doses, less frequently repeated, gave better results. In the present series a child of four received an initial dose of 25 c.c., which was repeated every fourth day up to a total of 130 c.c. A child of three months received, but one injection of 10 c.c. Another of five months received one of 10 c.c. and later one of 7 c.c. These cases are among the recoveries. When purulent exudate had formed on the brain and cord before the serum was injected, the results were

less favorable, as the serum is bactericidal and only slightly antitoxic. On this account it is injected directly into the spinal canal. In lumbar puncture one should use a needle accurately fitting a syringe holding 15 c.c. If the fluid shows turbidity remove 30 to 40 c.c. of it, warm the antiserum to body temperature, and inject slowly after removing the fluid. Every turbid specimen of fluid premises the diplococcus. In none of the recovered cases so far treated is there any evidence of hydrocephalus, mental impairment, or other disabilities usually following this disease.

The Urine in Gastro-intestinal Diseases of Infancy.—JOHN LOVETT MORSE and BRONSON CROTHERS (*Archives of Pediatrics*, August, 1909, xxvi, 561) quote the opinion of Koplik, who believes that renal complication is quite a factor in gastro-enteritis, and that often the stupor, delirium, convulsions, and œdema in severe cases are due to uremia. Hohlfeld, in a number of investigations, found that in the majority of fatal gastro-enteric cases the urine contained albumin and a few casts. In 35 autopsies the changes in the kidneys were found to be parenchymatous. He believes that toxemia and kidney irritation react on each other and offer a bad prognosis. Chapin, in 86 cases, records 75 as having albumin and casts in the urine; also the majority of the fatal cases had albumin in the urine. The authors tested the urine in 300 babies suffering from gastro-intestinal conditions. The examinations were consecutive. The tests for albumin were nitric acid (cold), acetic acid and heat, or both. In children with chronic digestive disturbances albumin was found in but 8 per cent. There was usually only a trace of it, with no casts and no œdema. The presence of the albumin had no effect on the prognosis. In acute conditions albumin was found in a little over 10 per cent. of the cases. There was usually only a trace of it without casts or blood and this had no effect on prognosis. The mortality was considerably higher in the intestinal cases with albumin than without it. These were not accompanied by œdema. The authors conclude that the pathological condition in the kidneys does not progress beyond cloudy swelling or acute hyperemia. There was nothing to suggest any causative relation between the affection of the kidneys and stupor, restlessness, and convulsion. These they believe are due to toxemia and not to uremia. The large number of cases examined give a general idea of the frequency of renal complication, and the importance of the urinary findings in prognosis from the clinical side. No autopsies were reported.

OBSTETRICS.

UNDER THE CHARGE OF

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The Factors Producing Internal Rotation in Labor.—PARAMORE (*Jour. Obstet. and Gyn. Brit. Empire*, October, 1909) has reviewed the literature of the subject and concludes from this and from his own investiga-

tions that descent and internal rotation take place essentially as follows: When flexion is good the point of impact of the vertex occurs at the extremity of a line drawn at right angles from the centre of the plane of the brim, reaching the pelvic floor in the region of the coccyx. The muscular fibers arising from the spines of the ischia and inserted into the coccyx, and the muscular fibers extending from the anus to the coccyx are hypertrophied during pregnancy. They form distinct muscular bundles very tender on pressure and capable of contraction. The vertex first impinges against this portion of the pelvic floor and uterine contractions force the pelvic floor downward at this point. The pelvic floor yields to the centre, the coccyx slopes downward and forward, forming an inclined plane down which the vertex is pressed. With the forehead posterior it descends behind the vertex, occupying the middle line posteriorly. The transverse diameters of the pelvis become diminished, while the anteroposterior are increased as the outlet is reached. The forehead is forced toward the hollow of the sacrum by the increased pressure between it and the posterolateral surfaces of the pelvic wall. If the forehead be anterior, cases may be divided into groups, one in which the head is well flexed, and one in which the head is not well flexed. When flexion is good the vertex meets the pelvic floor in the region of the coccyx, and is gradually forced lower and yet anterior toward the symphysis. As labor continues the forehead is compressed obliquely upward. The descent of the forehead is prevented by the projecting forward of the vertex, the pressure of the pelvic floor preventing the vertex and occiput from retreating. The fœtal chest forced against the chin prevents the forehead from ascending above the pelvic brim; the forehead passes into the larger transverse diameter, allowing the cranial axial line to move toward the symphysis. Uterine contractions and the frictional resistance of the side wall of the pelvis and forehead cause the occiput gradually to rotate to the front, while the forehead turns into the hollow of the sacrum. The factors concerned in causing rotation are the expulsive force from above, the obstructing central fixing force from below, the shape of the pelvis, and the shape, size, consistence, and position of the fœtal head

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Polyhydramnios Complicated with Œdema.—CAIE (*Jour. Obst. and Gyn. Brit. Empire*, October, 1909) reports the case of a patient in her second pregnancy, who, at the sixth month, was taken with severe pain in the back and side with general abdominal distress. On examination there was marked œdema of the lower extremities, dyspnœa and irregular heart action, with loud mitral and pulmonary bruits. The pain was referred to the left side about the lower dorsal vertebræ, extending to the umbilicus. The abdomen was tense and dull, and fœtal heart sounds could not be heard. The urine was scanty, containing a trace of albumin, and on vaginal examination nothing could be detected except ballottement which was very plainly present. Under rest and medical treatment the patient's condition somewhat improved. A month later the patient was very much worse. Œdema had become so pronounced that the patient was confined to her bed. Emaciation had developed and the facial expression resembled that of ovarian cyst.

The heart sounds were irregular and intermittent. On attempting to induce labor the œdema of the vulva was so pronounced that this procedure was impossible. Small trocars were inserted in the labia, and when the œdema had sufficiently subsided the membranes were ruptured. Labor gradually developed and the patient was delivered by forceps of a dead child. The puerperal period was complicated by intense after-pain, with temperature rising to 100° several times. Over the abdomen and inner sides of the thighs urticaria of a very persistent and irritable type developed. On the eighth day the patient had a chill with temperature rising to 104°. This speedily subsided, the patient ultimately making a good recovery. The amniotic liquid was analyzed and found alkaline, with a specific gravity of 1010, and contained urea and albumin with epithelial scales and various salts.

Pregnancy Complicated by Nephrectomy and Ovariotomy.—ANDREWS (*Jour. Obst. and Gyn. Brit. Empire*, October, 1909) reports the case of a small, delicate-looking woman, aged thirty-two years, who had had the right kidney removed for hydronephrosis. The kidney had been movable and the surgeon who operated did not intend to remove it; but on exploration it bled so freely and was so disorganized that removal became imperative. When Andrews saw this patient she was seven months pregnant, and in addition had a cystic tumor the size of a fœtal head on the right side of the abdomen. She was admitted to the hospital and upon operation a unilocular cyst containing three pints of fluid was removed. The patient had severe vomiting after operation with rapid pulse, and seventy-two hours after the removal of the tumor a male child was spontaneously born. Mother and child made a good recovery. The patient subsequently had her tenth child within a year of the ovariotomy. This patient's case demonstrates the possibility of successful pregnancy after the removal of one kidney, even though the patient's condition was complicated by ovarian tumor.

Complete Rupture of the Uterus Treated by Operation.—LEA (*Jour. Obst. and Gyn. Brit. Empire*, October, 1909) reports 5 cases of rupture of the uterus treated by abdominal hysterectomy, with 3 recoveries, at St. Mary's Hospital, Manchester, within the last three years. His own case was that of a woman in her third labor, the two previous having been terminated by forceps. The membranes ruptured before the head descended and engaged, when the physician called to see the patient, applied the forceps, making repeated efforts to deliver under anesthesia, without success. Shortly afterward the patient had marked pallor and rapid pulse with slight hemorrhage from the vagina. She was immediately transferred to the hospital. On admission, the fœtal head was lying above the pelvic brim, and evidently the uterus had completely ruptured. On section a full-term fœtus was found among the intestines, the head resting upon the promontory of the sacrum. The placenta had also been expelled. The anterior wall of the uterus had been completely torn across, the tear extending into the left broad ligament. The uterus was rapidly removed by clamping the upper portions of the broad ligament, the cervix, which was widely dilated and torn, was inverted toward the vagina, and the peritoneum was stitched over

the stump. The abdomen was closed without drainage. The vagina was thoroughly cleansed, and gauze packing introduced within the cervix. Intravenous saline transfusion was given. The patient made an almost uncomplicated recovery. On examination the pelvis was found considerably contracted in the anteroposterior diameter. This case calls attention to the familiar error of applying forceps to the fœtal head before engagement and descent.

Suprasymphyseal Section for Pelvis of Moderate Contraction.—KUPFERBERG (*Zentralbl. f. Gyn.*, No. 45, 1909) reports 4 successful suprasymphyseal sections with recoveries of both mothers and children. He had previously performed 10 pubiotomies, 6 of them followed by operative delivery, and 4 by spontaneous expulsion of the child. In one case after pubiotomy and the high application of the forceps, it was necessary to perforate the child to secure delivery. In one case after pubiotomy, when the operator waited for spontaneous delivery, fever developed and he was obliged to terminate labor by the Porro operation. In one case after pubiotomy severe expulsive efforts developed and the child perished during the stage of expulsion. The result, so far as the mother was concerned, was 100 per cent. recoveries, and for the children 80 per cent. recoveries. The puerperal period was, however, complicated by lacerations and by the formation of hematoma. The shortest time taken for recovery was fourteen days, and the longest five weeks. In his ten patients recovery seemed excellent, the patients retaining the power of motion without complication.

In choosing the suprasymphyseal section he employed Latzko's method. This consists in making a transverse incision through the fascia and abdominal wall above the pubes and a longitudinal incision through the lower uterine segment and cervix. The bladder is partially filled by salt solution and the peritoneal tissue is separated from the connective tissue in the vicinity of the bladder by gauze pressure. One of the four cases was of especial interest. The patient had a contracted pelvis, the true conjugate measuring 8.5 cm. An effort was made during labor to deliver the patient with the forceps, but the blades slipped from the head. Hematoma developed in the left wall of the vagina and rapidly increased in size. On admission it was almost impossible to examine the patient because the hematoma nearly filled the vagina. A suprasymphyseal section was then performed with great difficulty, because the patient was very fat. The child was delivered by forceps with very free bleeding. It weighed seven and three-quarter pounds and was delivered alive. The peritoneum was lacerated to some extent during labor and immediately repaired. The bladder was punctured by a needle during the operation, and a stitch was taken over the point of puncture, and permanent drainage by a catheter instituted. Thirty-six hours after operation symptoms of peritonitis developed, and the abdomen was opened on the left side, under local anesthesia. The peritoneum was drained and an artificial anus made in the iliac region. As the patient did not improve in twenty-four hours, incision was practised on the right side of the abdomen, when an ovarian cyst the size of a child's head, with twisted pedicle, was discovered. This was removed and the peritoneal cavity drained.

The patient commenced speedily to improve and was convalescent in fifteen weeks. On examination before her discharge the uterus was normal in size, drawn a little toward the right side, the cervical portion slightly fixed. Both intestinal fistulas had closed and the patient's condition was satisfactory.

In the Clinic in Mainz the following is the treatment of medium grades of contracted pelvis: Under favorable conditions, with examination under anesthesia from the thirty-second to the thirty-fourth week, the induction of labor. If the patient comes to full term and goes into labor and the child dies, embryotomy. If the child is living and in good condition, examination is made under anesthesia, and if engagement and descent are impossible and the patient is a primipara, suprasymphyseal section is performed. If the patient is a multipara, pubiotomy is selected.

GYNECOLOGY.

UNDER THE CHARGE OF

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The Prevention of Adhesions in Abdominal Surgery.—J. C. WEBSTER (*Surg., Gyn., and Obst.*, 1909, viii, 574) states that such general conditions as prolonged anesthesia, systemic weakness, and anemia may contribute to the formation of adhesions following abdominal operations. But, experimentally, in dogs such adhesions may be produced by undue exposure to dry air, cold air, mechanical trauma, and cultures of microorganisms. Webster thinks we should, therefore, avoid these factors as far as possible in abdominal surgery. The temperature of the operating room should be as high as 90° F., the degree of humidity high, the peritoneum covered as much as possible with gauze wet in hot salt solution, self-retaining, if any, retractors used, a minimum amount of sponging done, and, so far as possible, all denuded areas covered either by surrounding peritoneum sutured with fine catgut, or by omental grafts.

Results of the Treatment of Uterine Carcinoma.—G. KLEIN (*Monatsschrift f. Geburtsh. u. Gynäk.*, 1909, xxix, 710) found among 15,074 patients of his private practice and the Polyclinic of the Munich University, 421, or 2.79 per cent., with carcinoma of the uterus; 106 of these refused radical operation. Of the remaining 315, only 126 were radically operated upon, giving an operability of 40 per cent., which compares favorably with the findings of other operators. The primary mortality was greater in abdominal radical operation than in vaginal operation—in private practice 16.1 per cent., in the Polyclinic, 9.5 per cent. mortality. Among 204 cases whose histories were obtainable after five years it was found that only 8, or 3.6 per cent., were absolutely cured. Klein severely

criticises the methods of "decorative juggling" of statistics, and adds that recourse to such measures would most favorably affect the results obtained, but would obscure real facts. Careful study of reported statistics would reveal about the percentage of cures obtained in this instance. The operative prognosis in uterine cancer at best is very unfavorable.

Fibromas of the Uterus.—ELLICE MCDONALD (*Jour. Obst. and Gyn. Brit. Emp.*, 1909, xvi, 84) concludes from the examination of 700 specimens of fibromyomas: (1) The menopause does not bring a cure to fibroids; on the contrary, increasing age increases the danger from these growths. (2) There is little danger of malignancy arising in fibroids before forty years of age, after which time the danger increases with each year. (3) In view of the sarcomatous changes, carcinomatous associations, and other degenerations of uterine fibromyomas, early removal is indicated when they are of sufficient size to produce symptoms and cause the patients to seek advice. Small uncomplicated fibroids in young women do not require early treatment. (4) Thorough pathological examination should be made of all fibroids for evidence of malignancy. The tumor should be opened at the time of operation and examined for adenocarcinoma or sarcoma. Particular study should be devoted to those tumors which are necrotic, cystic, or both, as among these are found the largest proportion of malignant changes. (5) In view of the large percentage of inflammatory changes in the Fallopian tubes and appendix, these should be examined at the time of operation, and removed if diseased.

Some Difficult Cases of Urinary Fistulæ in Women, with Remarks on Prophylaxis and Treatment.—Under the title given R. WORRELL (*Jour. Obst. and Gyn. Brit. Empire*, 1909, xvi, 99) reports several cases illustrating several varieties of urinary fistulæ in women, upon whom he had successfully operated by the plan devised by Colles and described by that celebrated surgeon in *Dublin Medical Journal*, of May, 1861. Worrell claims that the credit for devising this flap-splitting method should be, but usually is not, accorded Colles.

Ovarian Displacements.—C. H. STRATZ (*Ztschr. f. Geburt. u. Gynäkol.*, 1909, Band lxv, Heft 2, 283) concludes from his observations that displacements of the ovary are dependent upon an inherited or acquired lengthening of the infundibulopelvic and ovarian ligaments, as well as an extraligamentous position of the ovary, and are caused directly by mechanical injury and by changes in the anatomical relations of the pelvic viscera. Anterior displacements are very much less common than posterior displacements and complete prolapse. As a result of such displacements, there may be congestion, œdema, hemorrhage, and even oöphoritis and twisting of the ovarian pedicle. Recovery is commonly spontaneous, at times after simple reposition, and only exceptionally is operative procedure for the displacement as such necessary. Stratz considers the disease described by various authors as œdema of the ovary as nothing more than a symptom of displacement or, especially, of a twisting of the pedicle of a displaced ovary.

A New Kind of Gynecological Massage and Its Indications.—RICHARD HOGNER (*Amer. Med.*, 1909, xv, 408) describes a new kind of gynecological massage he is using for non-inflammatory pelvic diseases that is applied as follows: The patient lies on a double inclined plane about eighteen inches above the floor, the head and chest being comfortably elevated, the abdomen and the legs very much raised, thus getting the best relaxation of the abdomen and moving the intestines away from the massaging. The operator sits at the patient's left side, on the hard couch, his left hand and forearm in the median line of the patient, the elbow resting on the couch. Examination and massage are now made by the Brandt system, except after a short preliminary use a motor vibrator is used on the abdomen.

Results of Operation for Cervical Carcinoma.—PAUL REINECKE (*Ztschr. f. Geburt. u. Gynäkol.*, 1909, lxv, Heft 1, 130) has compiled the results of operation for carcinoma of the cervix uteri in the Würzburg University clinic from 1889 to 1907. Of the 526 cases appearing at the clinic, 215 were deemed operable and 311 inoperable. Total extirpation by the abdominal route was performed 66 times and by the vaginal route 142 times. High amputation of the cervix was performed 6 times. The primary mortality by the vaginal route was 12.67 per cent. Of 120 cases of complete vaginal hysterectomy operated upon previous to 1903, 16 died as the result of operation, 11 were lost track of or died as the result of other diseases, 62 had a return of the growth, and 31 were free from return after 5 or more years. A cure was therefore effected in 33.33 per cent. of the cases. In 77.42 per cent. of the return cases the condition was apparent during the first year after operation. The primary mortality by the abdominal route was 21.21 per cent. Of 27 cases operated upon previous to 1903, 7 died as the immediate result of the operation, 13 had a return of the cancer, and 7 remained well after five or more years. The percentage cured was therefore 35. Of the 6 cases of amputation of the cervix, 4 remained free from return and 1 was lost to view. The percentage cured was therefore 80. Combining the results obtained by the three methods, it appears that 42 out of 118, or 35.6 per cent., remained free from a return of carcinoma after five years, which comes very close to the results reported by Schauta, namely, 38 per cent.

Ovarian Papillary Adenocarcinoma with Polypoid Metastasis in the Endometrium.—L. ARZT (*Ztschr. f. Geburt. u. Gynäkol.*, 1909, Band lxv, Heft 1, 76) reports a carefully studied case in which a malignant papillary cyst of the ovary was believed to be the primary growth and a polypoid tumor in the cavity of the uterus the secondary growth. Both tumors had the same histological characteristics; the uterine tumor was not found to have any histogenetic relation to the mucous membrane of the uterus; and carcinoma cells were found within the veins of the uterus. Arzt believes that the growth was conveyed by way of the veins from the ovary to the uterus. He finds only three or four similar cases in the literature.

DISEASES OF THE LARYNX AND CONTIGUOUS STRUCTURES.

UNDER THE CHARGE OF
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Albuminuric Coryza.—CORNET (*Annales des maladies de l'oreille, du larynx, du nez, et du pharynx*, October, 1909) describes an albuminuric coryza, in which œdema of the pituitary membrane is the predominant element. He reports several cases, and states that he has found it one of the earliest symptoms of chronic nephritis, as verified by examination of the urine. The coryza itself yields to the constitutional antinephritic treatment.

Paraffin Injections in Ozena.—BOTEY (*Annales des maladies de l'oreille, du larynx, du nez, et du pharynx*, November, 1909) discusses the question whether injections of paraffin in ozena are today the best treatment for this affection, and as the result of considerable experience with solid paraffin comes to the conclusion that this is really the best treatment. His results have been 50 per cent. of cures, 35 per cent. of great amelioration, and 15 per cent. of slight amelioration. He states that a preliminary injection of water beneath the mucous membrane facilitates the subsequent injection of paraffin. His cures of ozena, or amelioration, continue intact for many years. In contrary cases he had to repeat the injections to reproduce the results at first achieved.

Remote Advantages of Ablation of Adenoid Vegetation.—POPPI (*Annales des maladies de l'oreille, du larynx, du nez, et du pharynx*, October, 1909) states, as a sequence of ablation of adenoid vegetations, he has seen cured two cases of exophthalmic goitre, one glaucoma due to lesion of the fifth pair of nerves and not relieved by iridectomy, and one case of Addison's disease. He suggests that the persistence of the craniopharyngeal canal, the vascular communication between the pituitary cavity and the pharyngeal mucous membrane, the presence of an accessory pituitary gland encountered sometimes in the pharynx, might cause an alteration in the secretory function of the pituitary gland, and indirectly, by intermediation of the grand sympathetic nerve and of the spinal marrow, of the other glands of internal secretion.

Rhinopharyngocele.—BROECKAERT (*Revue hebd. de laryng., d'otol., et de rhin.*, December 4, 1909) describes a typical, if not unique, instance of this rare affection in a male infant, aged eighteen months. The swelling had been observed at the left side of the neck at the age of two months, and it had progressed slowly and steadily until it had acquired the bulk of a medium-sized orange. It proved to be an aërocele, which could be entirely emptied by pressure and which became refilled with air upon release of the pressure. A protracted examination

revealed a very deep fossa of Rosenmüller upon the affected side. As the fossa of Rosenmüller is regarded as the remnant of the second branchial cleft, it was concluded that this rhinopharyngocele was derived from the same cleft, the two formations being but the two extreme sides of the same process. It was proposed to incise the pouch and resect the sac as completely as possible.

Acute Lacunar Tonsillitis.—HAHN (*Annales des mal. de l'oreille, du larynx., du nez, et du pharynx*, October, 1909) claims a cure of this disease in from twenty-four to thirty-six hours by the following procedure: Lavage of each crypt with a warmed mixture of hydrogen dioxide, twelve volumes, and a boric acid solution, 3 per cent.; then an injection into each crypt thus cleansed of a solution of novocain, 2 per cent. and adrenalin, 1 to 1000; finally, insufflation of anesthesin or of orthoform over the entire surface of the tonsil.

Spontaneous Resorption of a Morbid Growth of the Larynx.—GREENE (*Jour. Amer. Med. Assoc.*, November 6, 1909) reports the spontaneous "disappearance of a laryngeal growth, probably carcinoma, without treatment." The patient, aged fifty years, had a growth about the size and shape of a small grain of wheat attached to the upper and inner side of the left vocal band. It increased somewhat in size, and then suggestion was made to use tuberculin for diagnostic purposes, and, if no reaction occurred, to remove a fragment of the growth for examination, with the object of performing laryngotomy or even laryngectomy, should it be found to be carcinoma as its appearance indicated. The patient seemed to agree as to the probable diagnosis, but preferred to continue at his work as long as possible without operation. The tuberculin produced headache and dizziness, and was therefore discontinued, but the small dose used gave no sign of reaction either in the appearance of the growth or in rise of temperature. Four months later the patient appeared for reëxamination, and there was no sign of the growth to be seen. [Could this have been a tuberculoma and absorbed even with the small dose of tuberculin? J. S. C.]

Epithelioma of the Larynx Removed Through the Natural Passage with the Electric Caustic Snare.—GAREL (*Revue hebd. de laryng., d'otol., et de rhin.*, September 18, 1909) reports a pedunculated epithelioma, weighing two and one-half grams, which he removed from the larynx of a man, aged sixty-two years, with the electric caustic snare. The eschar showed that the section had been made at the point of junction at the left aryepiglottic ligament with the posterior border of the epiglottis. Eight months after the operation there had been no sign of recurrence. [This is one of the rare instances in which endolaryngeal procedure is justifiable for the removal of malignant neoplasms. J. S. C.]

So-called Multiple Osteomas of the Tracheal Mucous Membrane.—MUCKLESTON (*Laryngoscope*, December, 1909) presents a review of the published cases of multiple ecchondromas and osteomas of the tracheal mucous membrane, and reports two cases of his own. One, illustrated, shows a section of the trachea and cricoid cartilage with

ecchondrosis surmounted by flat plates of bone. [It has always seemed that this condition is one of the exemplifications in which disease of tissues produced premature senile changes. J. S. C.]

Rhinopharyngeal Fibroma Fatal by Intracranial Extension.—GAUDIER (*Revue hebd. de laryng., d' otol., et de rhin.*, October 23, 1909) reports this case in a child from whom, at eleven years of age, he removed a rhinopharyngeal fibroma with great difficulty after external access by resection of the upper jaw. Two years later the patient returned on account of profuse hemorrhage from the nose and the mouth, which had existed about a month. On examination, there was no trace of recurrence of the growth. Nevertheless, the patient died suddenly the same day of a violent hemorrhage. Autopsy revealed a voluminous extension of the tumor saddling the sella turcica and raising the dura mater, and penetrating one side into the thickness of the sphenoid bone. The report of the case is followed by a resume of a few similar cases on record.

HYGIENE AND PUBLIC HEALTH.

UNDER THE CHARGE OF

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Tuberculosis.—The *Transactions of the Sixth International Congress on Tuberculosis* contain much valuable material which will be of the greatest service in the campaign against this disease. From the special lectures we make the following abstracts: Kitasato, discussing tuberculosis in Japan, shows the awakening of that nation and its active participation in the affairs of the world, at first developed factors which added to the increased spread of infection. The development of industry, by bringing a large number of people together, often under unsanitary conditions, the frequency of communication, the unequal development and distribution of wealth, putting a wide gulf between the rich and the poor—all of these have contributed to the spread of tuberculosis in Japan. In 1890 the death rate from tuberculosis did not exceed 11.4 per 10,000, but by 1900 it had reached 18. In 1904 the government inaugurated certain measures against this disease, the most important of which are the following: Spittoons are provided in all places of assembly, schools, hospitals, factories, ship stations, theaters, amusement halls, hotels, etc. The spittoons contain some disinfectant, and no one is permitted to expectorate save in these receptacles. In all hotels the bedclothes must be covered with white sheets, which are changed with change in guests. When an occupant is suspected of being tuberculous the room must be disinfected before another guest can be lodged therein. Tuberculous individuals in hospitals and prisons are isolated. These regulations are already having a recognizable effect upon the death rate from tuberculosis.

Pannwitz, under the title of "Social Life and Tuberculosis," gave a most inspiring address. In this he points out that tuberculosis must

be placed in the first rank of the dangerous accessory phenomena of social life. "Every third death during the working period of life is caused by pulmonary tuberculosis; every other workman who becomes incapacitated must ascribe his condition to tuberculosis. What frightful destruction of human labor! What a loss in development! What clouding and destruction of human happiness! How much progress is arrested by this disease! How much physical and mental effort is cut off prematurely! How many hopes for the future are blasted! What an enormous aggregate of misery is caused daily in our family life! Verily, tuberculosis has become the scourge of mankind! At the beginning of the twentieth century it stamps its mark on our entire social existence. It has become in our age the social disease."

Two things are essential to the development of this disease—the bacillus and susceptibility. The former may come from infected food, but in the majority of instances is distributed from some infected individual and is inhaled by the recipient. The chances of infection are multiplied by the density of the population and by the occupation of closed spaces. Intimacy of contact is an important factor in the spread of the disease, and for this reason one member of a family infects the others, and the more crowded the habitation the more frequent is the infection. The inhalation of dust or any irritative particles open up avenues in the respiratory passages for infection. Among the poor and the ignorant living in crowded quarters the infection of one generally means the ultimate infection of all. Predisposition may be acquired or hereditary. Insufficient food diminishes resistance, and tuberculosis among the poor is to be combated by securing for them sanitary dwellings, nutritious food, and by instructing them in sanitary matters. Sanatoria must be provided not only for the treatment, but for the education of the tuberculous. In Germany about one fourth of the inhabitants are insured against disability. More than 1,500,000,000 marks have been paid into this fund. More than one hundred free sanatoria are in operation; more than 50,000 tuberculous workingmen pass annually through these institutions, and an average of 75 per cent. return able to support their families. In 1886 the death rate from tuberculosis in Prussia was 31.4 per 10,000; in 1906 it had fallen to 17.26. "At the end of the twentieth century the social qualities of people will be judged by their relation to tuberculosis." Pannwitz quotes Laquer as follows:

"The fight against tuberculosis has strengthened the social sense of the people and has set fresh goals for altruism. It has focussed the effort of nations, social classes, employers and employed, physicians and laymen in a common social ideal. It has rendered the individual as well as the mass of the people, which at bottom are antisocial and egotistical, both capable and ready to help indulgently and companionably. It has called into being a new feeling by assembling in Germany more than 40,000 human beings every year in sanatoriums; or, in other words, united them in a common striving for hygienic perfection; it has taught those who are weary and heavy laden the workings of the state, of the parish, and of insurance institutions, by showing the monumental results accomplished; it has drawn the sting of capital and has freed the lower classes from the sense of being abandoned in their hour of greatest need and danger. Every improved and cured tuberculosis subject becomes a propagandist of social doctrines. The sight of

children departing from the railroad station to join vacation colonies in forest retreats or convalescent homes is inexpressibly touching, and acts like the reading of a gospel more powerful than the Sermon on the Mount."

Newsholme points out that the most potent factor in the decrease of tuberculosis has been institutional segregation, and this is especially true when advanced cases have been cared for. He says:

"The institutional treatment which it is claimed has played a predominant part in the past reduction of phthisis has been in the main the institutional treatment of patients who were disabled by sickness, rather than of earlier and less severe cases. This is not the occasion for discussing the evidences as to the relative infectivity of early and advanced cases of disease. There can, I think, be no doubt that advanced cases are more infectious than earlier cases. But no responsible administrators having regard to the prevention of tuberculosis will content themselves with the treatment of advanced cases. They will treat early cases in the hope of securing recovery of the patient; and intermediate cases in the hope of restoring a modicum of health, as well as of educating the patient so that he will no longer be a source of infection to his family and his fellow workmen."

Probably the most interesting thing in the paper on the "History of the Treatment of Consumption," by Williams, is his description of the graded work now imposed upon some of the patients at the Brompton Hospital. No work is permitted if the temperature is above 99°. In others the work is divided into the following classes: (1) Walking from one to ten miles a day. (2) Carrying baskets of earth or other material, and gradually increasing the load. (3) Using a small shovel. (4) A large shovel. (5) Using a pickaxe, and (6) doing this for six hours a day. In many of the German resorts graded climbing has been used in the treatment of incipient cases since the time of Brehmer, but the graded work at the Brompton Hospital is the first systematic application of this method of treatment, and it is interesting to know that it seems to work beneficially. It certainly relieves the monotony of institutional life.

Volashimiroff in his lecture on the "Biology of the Tubercle Bacillus," states that these organisms have accumulated the fats and waxes contained in their cells for their own protection. "Thanks to the presence of this precious wax, the bacillus of tuberculosis is relieved of the necessity of forming spores, which other organisms are obliged to form in order to survive the unfavorable contingencies of life."

In his brilliant lecture on "One Hundred Years of Phthisiology," Landouzy dwells upon the conflict between the unicists and dualists. For awhile the great authority, Virchow, who taught that phthisis and tuberculosis were different diseases, gave the lead to the dualists. The famous phrase of Niemeyer, "The greatest danger that threatens a consumptive is to become tuberculous," strengthened this error, which was finally overthrown by the discoveries of Villemin and Koch. The studies of Villemin from 1865 to 1869 are summed up in the sentence, "Tuberculosis is caused by a morbid germ capable of multiplying in the organism. The inoculation of tubercle does not act through any visible or palpable matter that enters with this pathological product, but through a more subtle agent which is contained in it, and which

escapes our perception." The "subtle agent" was detected and isolated as the tubercle bacillus by the painstaking labors and genius of Koch. Upon these discoveries the science of modern phthisiology has been developed.

In his lecture on "Tuberculosis in Animals," Bang states that a hundred years ago the cattle of Denmark were wholly free from this disease, which was introduced by importation from Switzerland, Germany, and England. The cattle of Norway, Sweden, and Finland became infected later, also from importations. The entirely healthy herds are those that multiply from their own breeding, while the disease is found when the farmers trade cattle and import animals descended from infected herds. Inbreeding does not develop the disease; it must be imported in order to find its way into a healthy herd. The tubercle bacillus is not ubiquitous. If it were, it would be impossible to have healthy herds in a village in which other herds were infected. It is living for long periods in enclosures, stables, etc., in association with tuberculous individuals suffering from open tuberculosis. Congenital tuberculosis in cattle has been found in from 0.5 to 1 per cent. of the calves examined in Demnark. This occurs, however, only when the uterus itself is tuberculous, or bacilli circulate in the blood of the mother. The majority of cows reacting to the tuberculosis test bear healthy young, and when these are removed from the mother they remain healthy. It is quite proper to apply this knowledge to children. Remove the child from the tuberculous mother and the tuberculous home, place it in healthy surroundings, and take care that it is not infected through milk, and it will continue healthy. When the udder is tuberculous the milk contains a great number of bacilli, and of course should not be used in feeding either calves or children. However, bacilli may find their way into the milk even when the udder is not affected. Under the most perfect conditions of stabling and milking, some dust, which may be infected, is likely to find its way into the milk. Cows with tuberculous udders should be killed, as they are not fit for either breeding or supplying milk. Annually about 700 such cows are killed in Denmark, but their number is less than one per thousand since there are in that country about 1,000,000 milch cows. Bang does not agree with Koch in his opinion concerning the harmlessness of the bovine bacillus to man. The infant is much more susceptible to the bovine bacillus than is the adult.

Want of space forbids abstracts from other valuable lectures in this series.

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